FALCON ENERGY LIMITED

Energy Conservation Specialists

151 Station Road
West Drayton

Energy Statement

Client: Peter Kearns Development Ltd

Assessor: Neil Vanson

Tel: 01403 253439
Email: info@falconenergy.co.uk
Web: www.falconenergy.co.uk

Report By: Neil Vanson

Checked By: Neil Vanson

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Energy/ Sustainability Statement

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Disclaimer

This report is for the use of the client only and is not for the use of any other parties without the express permission of the client. All energy calculations, related quantified predictions are indicative for planning and are based solely on the available design proposals and must be reassessed during detailed design with the appropriate compliance methodology.

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Energy/ Sustainability Statement

1. Executive Summary

The Council will require all new developments, and where possible via a retrofitting process in existing developments to address the causes and impacts of climate change by minimising energy use; supplying energy efficiently; and using energy generated from renewable sources in line with London Plan and national policy. The Council will support appropriate measures to mitigate and adapt to the impacts of climate change and will reduce emissions of carbon dioxide as part of development proposals, in line with the London Plan. The Council will set local standards and targets, based on an understanding of local potential and opportunities for renewable or low carbon energy and existing or planned decentralised energy infrastructure. Where opportunities are identified, development will be required to contribute towards realising these opportunities subject to the Council and its partners undertaking further work that is required to explore the feasibility and development potential of projects or strategies in order to take them forward. The Council, working with its partners, will seek to ensure that Hillingdons future energy infrastructure needs are managed effectively by ensuring that the necessary infrastructure is in place to accommodate the levels of growth anticipated within the Borough.

To assist the application of an energy assessment shall be submitted to and approved in writing by the Local Planning Authority. The assessment shall:

1 - set out the annualised baseline energy demand (kWhr) and CO2 levels (KgCO2) of the development built to SAP 10.
2 - set out the design measures and features that reduce the baseline emissions relative to the London Plan Hierarchy (be lean, be clean, be green)
3 - provide the impacts of the measures and features from [2] on the baseline energy demand and emissions [1]
4 - provide full details, including (but not limited to), of types of lighting, boiler specifications, Combined Heat and Power networks and plant technology, zero carbon technology including roof plans and PV specifications.
5 - methods to monitor and maintain the development to ensure the targets are achieved and met consistently Thereafter, the development shall be carried out and completed in accordance with the approved assessment.

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REASON

To ensure the development contributes to a reduction in CO2, in accordance with the London Plan (2021).

The energy strategy for the proposed development scheme has been assessed using the Energy Hierarchy to demonstrate compliance with the London Borough of Enfield's requirements for a 35% CO2 reduction beyond Building Regulations SAP 10.

An energy efficient scheme has been proposed that has reduced the CO2 emissions through passive design measures, increasing insulation in the building fabric to reduce heat loss, improved heating and lighting systems and controls. These measures have resulted in predicted CO2 emissions that are achieving SAP 10 baseline requirements.

2. Introduction

The proposals comprise the erection of 6 units with associated parking.



Figure 1, Location plan

151 Station Road, West Drayton

Energy/ Sustainability Statement

3.0 Planning Policy (London Plan)

The London Plan Spatial Development Strategy for Greater London, July 2011, in Chapter 5 London's Response to Climate Change, requires in Policy 5.2 for all buildings to reduce their carbon dioxide emissions beyond building regulations, following the Energy Hierarchy:
Be lean: use less energy
Be clean: supply energy efficiently
Be green: use renewable energy
The London Plan includes strategic targets for carbon dioxide reduction to enable the Mayors Climate Change Mitigation targets to be met (Policy 5.1). The current target requirement is to reduce carbon dioxide emissions by 35% beyond Building Regulations SAP 10.

Residential buildings:	
Year	**Improvement on 2010 Building Regulations**
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

Non-domestic buildings:	
Year	**Improvement on 2010 Building Regulations**
2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

4.0 Design targets

The Energy Assessment shall demonstrate how the proposed development shall try and meet the targets of both the Hillingdon Council and the London Plan. The requirements are:

35% improvement on SAP 10 Building Regulations

5.0 Baseline SAPs

To determine the baseline CO2 emissions for the development the following was undertaken for the Flats within the proposed scheme. SAP calculation demonstrating compliance with Part L SAP 10 were undertaken on the dwelling using the Notional U values.

Baseline Assessment Results

Baseline	SAP CO2 t/yr
House 1	1.52
House 2	1.39
House 3	1.39
House 4	1.52
House 5	1.19
House 6	1.43
Total	**8.44**

6.0 Be Lean-Energy Efficient Scheme

The first step of the energy hierarchy is to improve the design of the building fabric and services to maximise the energy efficiency and minimise the energy requirements. To reduce the CO2 emissions from the Houses, the following improvements were made to the building design.
The heat loss from the dwellings have been reduced by increasing the levels of insulation in the building fabric to achieve U-values significantly better than SAP 10 performance standards, shown in Table 6.1. This shall reduce the energy requirement for heating and therefore the energy consumption and CO2 emissions associated with the heating.

	Target U Value Lean Specification W/M2 K	***SAP 10 Baseline (Notional)***
External Walls	***0.16***	***0.18***
Roof	***0.10***	***0.11***
Floor	***0.11***	***0.13***
Glazing (including roof lights)	***1.10***	***1.20***
Doors	***1.10***	***1.20***
Air Permeability	***4.00***	***5.0***
Main heating	***Gas***	***Gas***

Table 6.1

Natural ventilation shall be maintained for the dwelling with energy efficient extract provided to the kitchen and bathrooms only. This shall have very low specific fan powers and shall only operate when the kitchen or bathroom is occupied, to minimise energy consumption.
100% energy efficient lighting will be installed throughout. The lighting will in the common ways shall be controlled via PIR sensors to enable the lighting to only be switched on in areas where it is required. This shall enable the energy consumption associated with lighting to remain as low as practicable. Energy display devices shall be provided to each dwelling to enable occupants to review and understand their energy consumption and therefore take steps to minimise energy in use of the dwelling. The energy display devices shall measure and transmit energy consumption data to a visual display unit. The visual display unit shall display the following information as a minimum:

- Local time
- Current mains energy consumption (kilowatts and kilowatt hours)
- Current emissions (g/kg CO2)
- Current tariff
- Current cost
- Display accurate account balance information (amount in credit or debit)
- Visual presentation of data (i.e., non-numeric) to allow consumers to easily identify high and low level of usage
- Historical consumption data

7.0 Be Lean Assessment Results

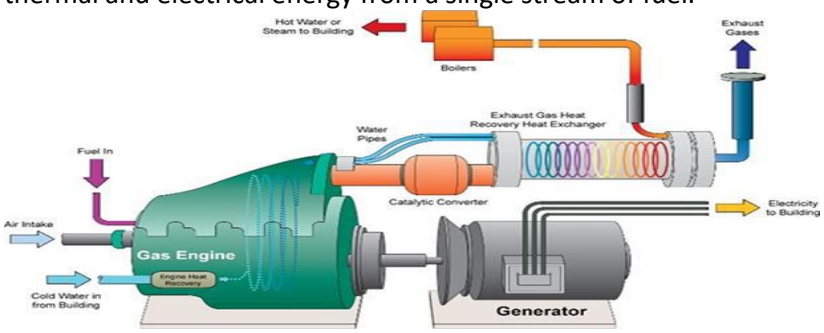
The energy demand and resulting CO2 emissions for the energy efficient Be Lean scheme are presented in Table 6.2 and show the CO2 emissions are reduced by 0.38 t/yr

Be Lean Assessment Results

Lean DER	SAP 10 CO2 t/yr
House 1	1.43
House 2	1.32
House 3	1.32
House 4	1.43
House 5	1.12
House 6	1.43
Total	8.05

8.0 Be Clean

Combined heat and power (CHP), also known as cogeneration, is the simultaneous generation of thermal and electrical energy from a single stream of fuel.



CHP installations can typically convert between 80% and 90% of the energy in the fuel into electrical power and useful heat. By generating the electricity in an on-site CHP unit, and utilizing the heat, electricity from conventional power stations is displaced and the substantial conversion,

transmission and distribution losses are avoided. The resulting efficiency gives typical small-scale CHP installations a simple payback period of between 3 and 5 years, beyond which the units continue to save energy right up until the end of the life of the plant.
Systems must be 'heat lead' for high efficiency, which best suits applications to situations where there is a significant demand for heat for long periods of time, such as hospitals, hotels, and leisure centres. Due to the nature and limited size of this residential scheme, CHP would not be applicable as there is not a constant heat requirement. It is likely there will be a small number of peak

demands, e.g., between 6am – 7.30am as residents shower in the morning, rather than a steady load throughout the day.

In the London Plan Policy 5.5 Decentralised Energy Networks, the Mayor expects 35% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. Plans show there are no existing district heating networks that the proposed scheme could connect to. **Therefore, CHP either on-site or via an existing network is not a viable solution for this residential scheme**.

9.0 Be Green use of renewable energy

The following low and zero carbon technologies have been considered for the scheme:

10.0 Ground Source Heat Pumps

A ground sourced heat pump (GSHP) is a device for extracting heat from the ground to provide space heating and domestic hot water for buildings. Water or another fluid is circulated through pipes buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid. The heat pump then raises the temperature of the fluid via the compression cycle to supply hot water to the building as from a normal boiler.

Providing the space heating requirement only using ground source heat pumps would provide 60% CO2 reduction over the lean building. This would require approximately 4 boreholes across the site, spaced between 25m to 50m centres, or horizontal coils would require an area of approximately 2,400m2. Using GSHP for 100% of the space heating will only provide a 45% reduction on predicted CO2 emissions. As this is based in London and is being built on an existing plot there is no space for the Boreholes to be sited. **Therefore, this is not considered to be viable for this project.**

11.0 Air Source Heat Pump

Air Source Heat Pumps extracts heat from the outside air through a using an external condenser unit and transfers it, through refrigeration pipework to the indoor unit which then conveys that heat to the heating emitters and hot water cylinder. This system is capable of providing 100% of heating within a building.

Providing air source heat pumps to the building for the space heating would reduce the carbon dioxide emissions by 13.8% from the Lean building.
This system would require a significant number of external condenser units to be located external to the building, which would have space and noise implications, potentially requiring acoustic screening. The external condensers would also need to be approved through the planning application process. **Due to these constraints combined with the low CO2 reduction, this technology is not considered viable.**

12.0 Biomass

Waste timber, in the form of wood chips and pellets, is used as fuel in boilers providing heating to buildings. Biomass generates about the same amount of carbon dioxide as fossil fuels, however, with new plant/tree growth this carbon dioxide is actually removed from the atmosphere making the Biomass system carbon neutral. Wood chips and pellets present no risk if accidentally released into the environment and there are no harmful by-products. The flue gas is smoke-free and the ash content of between 0.5% and 3% by volume (depending on material), is minimal.
When sizing biomass is standard practice the biomass boilers would meet a significant proportion of the heating load and gas condensing boilers would assist with providing load trimming to reduce the amount of on/off cycling of the biomass boilers. The provision of biomass boilers to meet all the domestic hot water demand and 30% of the annual energy demand for space heating only would reduce the carbon emissions of the building by 40%.

The provision of biomass boilers for this site would require a central energy centre to be provided sized to allow for at least one biomass boiler and gas backup boiler(s). The number of boilers would be dependent upon detailed analysis of the demand load profiles during detail design stage. Storage of the biomass fuel is required on site, sized to accommodate at least one peak month of heating. Based on the predicted domestic hot water and 30% heating requirements, this would require 10m3 storage for wood pellets or 755m3 of woodchip, depending upon the boiler selection. The store would need to be easily accessed by a large delivery vehicle, similarly, sized to a petrol tanker and therefore there may be issues surrounding vehicular access to the site.

The space and access requirements for the energy centre and biomass store are unlikely to be viable on this site. Furthermore, the biomass boiler(s) would require a large flue and careful consideration of its sizing, location and the potential impact of local air quality would be required in this residential area. **Therefore, this is not considered to be viable for this project.**

13.0 Solar thermal

Solar water heating systems use the energy from the sun to heat water, most commonly in the UK for hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is passed through a heat exchanger and used to heat up water which is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. There are two types of collectors used for solar water heating applications - flat plate collectors and evacuated tube collectors. Evacuated tube collectors are generally more expensive due to a more complex manufacturing process (to achieve the vacuum), but manufacturers generally claim better winter performance. Due to the unit not having cylinders and the number of panels required this was felt not viable. **Therefore, this is not considered to be viable for this project.**

14.0 Photovoltaics

Solar photovoltaic (PV) technology is a semi-conductor-based technology that converts the energy in sunlight into electricity. The term describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of current when the solar cell is connected to an electrical load. The PV system should be unshaded. Shading even over a small area of the panel, can significantly reduce performance. We have factored in 5 kWp per House. **Therefore, this was considered to be viable for this project.**

Be Green Assessment Results

Be Green Assessment Results

Green	SAP 10 CO2 t/yr
House 1	0.96
House 2	0.85
House 3	0.85
House 4	0.96
House 5	0.65
House 6	0.96
Total	**5.23**

15.0 Summary of CO2 Emission Reduction for Scheme

The energy strategy for the proposed development scheme has been assessed using the Energy Hierarchy:
Be Lean: use less energy
Be Green: use renewable energy

	t/yr CO2	t/yr CO2Reduction	Reductions at each stage	Reduction from Baseline
Baseline	8.44	-	-	-
Be lean	8.05	0.39	4.62%	5.72%
Be Green	5.23	2.82	35.03%	38.03%

The scheme gets a 38.03% improvement over the baseline by the use of Solar P.V panels.

16.0 SAP Worksheets

Full SAP Calculation Printout

Plot Reference	Plot 1	**Issued on Date**	05/11/2026
Assessment Reference	Baseline	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	87 B	**DER**	11.09	**TER**	8.30
Environmental	89 B	**% DER < TER**			-33.61
CO_2 Emissions (t/year)	1.52	**DFEE**	29.04	**TFEE**	31.36
Compliance Check	See BREL	**% DFEE < TFEE**			7.38
% DPER < TPER	-42.73	**DPER**	61.73	**TPER**	43.25

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9981	0.9944	0.9823	0.9268	0.7880	0.5800	0.4237	0.4789	0.7549	0.9643	0.9951	0.9986	(86)
MIT	20.1000	20.2415	20.4479	20.7159	20.8817	20.9396	20.9472	20.9462	20.9102	20.6701	20.3414	20.0855	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9975	0.9928	0.9770	0.9067	0.7413	0.5139	0.3497	0.3998	0.6889	0.9503	0.9934	0.9981	(89)
MIT 2	19.1205	19.3034	19.5671	19.9054	20.0897	20.1520	20.1569	20.1585	20.1261	19.8586	19.4419	19.1104	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9909	0.9733	0.9024	0.7433	0.5211	0.3582	0.4089	0.6944	0.9461	0.9917	0.9975	(94)
Useful gains	852.7463	1004.6038	1126.7026	1208.9671	1078.8681	752.4601	493.7884	518.3634	790.2552	910.0077	842.6333	811.6679	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2086.2006	2019.7748	1826.6700	1514.4961	1155.4702	760.1502	494.4561	519.7894	827.9979	1273.4817	1703.7061	2069.1085	(97)
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98a)
Space heating requirement - total per year (kWh/year)												4223.5663	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4223.5663	
Space heating per m2											(98c) / (4) =	26.4585	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1096.4038	815.0477	622.1932	262.8206	68.0908	0.0000	0.0000	0.0000	0.0000	323.0879	740.7077	1117.7249	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5837	88.5677	88.5337	88.4471	88.3043	88.2000	88.2000	88.2000	88.2000	88.4720	88.5587	88.5865	(217)
Fuel for water heating, kWh/month	312.1379	275.5167	291.4106	253.1761	243.5668	217.2877	212.6934	222.5219	226.4890	254.6942	274.1108	308.2936	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 5046.0768 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3091.8986 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8568.4534	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5046.0768	0.2100	1059.6761	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3091.8986	0.2100	649.2987	(264)
Space and water heating			1708.9748	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1770.6229	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5046.0768	1.1300	5702.0668	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3091.8986	1.1300	3493.8454	(278)
Space and water heating			9195.9122	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9854.3848	(286)
Dwelling Primary energy Rate (DPER)			61.7300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			11.3400	19.6403	0.6300	0.7000	0.7700	68.0663 (76)				
West			5.7600	19.6403	0.6300	0.7000	0.7700	34.5734 (80)				
North			0.2500	15.2954	0.6300	0.7000	1.0000	1.5177 (82)				
South			1.0000	47.0123	0.6300	0.7000	1.0000	18.6592 (82)				
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965 (64)
Efficiency of water heater												80.3000 (216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279 (217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4813.0912 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5848 0.5815 0.5783 0.5632 0.5603 0.5471 0.5471 0.5447 0.5522 0.5603 0.5661 0.5721 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	137.3014	136.8634	136.4340	134.4173	134.0399	132.2834	132.2834	131.9581	132.9600	134.0399	134.8033	135.6013	(39)
Average = Sum(39)m / 12 =												134.4155	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8601	0.8574	0.8547	0.8421	0.8397	0.8287	0.8287	0.8267	0.8329	0.8397	0.8445	0.8495	(40)
HLP (average)												0.8420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.9320	73.1654	73.3957	74.4969	74.7066	75.6986	75.6986	75.8852	75.3134	74.7066	74.2836	73.8464	
alpha	5.8621	5.8777	5.8930	5.9665	5.9804	6.0466	6.0466	6.0590	6.0209	5.9804	5.9522	5.9231	
util living area													
	0.9988	0.9960	0.9862	0.9364	0.8025	0.5927	0.4332	0.4916	0.7729	0.9717	0.9966	0.9991	(86)
MIT	19.8379	20.0273	20.3055	20.6716	20.9049	20.9873	20.9983	20.9966	20.9437	20.6041	20.1584	19.8155	(87)
Th 2	20.2015	20.2039	20.2062	20.2170	20.2191	20.2285	20.2285	20.2303	20.2249	20.2191	20.2150	20.2107	(88)
util rest of house													
	0.9984	0.9948	0.9819	0.9182	0.7570	0.5260	0.3581	0.4112	0.7080	0.9601	0.9954	0.9988	(89)
MIT 2	19.1238	19.3144	19.5917	19.9520	20.1556	20.2225	20.2281	20.2292	20.1936	19.8961	19.4546	19.1087	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9933	0.9787	0.9149	0.7622	0.5387	0.3728	0.4270	0.7184	0.9567	0.9942	0.9984	(94)
Useful gains	785.3285	940.4418	1070.6395	1174.6195	1067.2523	754.6366	499.1178	523.4005	785.3459	869.2465	784.1469	745.0492	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.5719	1991.9565	1805.2689	1504.5682	1153.0991	763.6230	499.9302	525.1711	829.7765	1264.6724	1684.0577	2040.4538	(97)
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98a)
Space heating requirement - total per year (kWh/year)												4404.8460	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4404.8460	
Space heating per m2											(98c) / (4) =	27.5941	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1243.4642	978.8974	1002.8819	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9294	0.9684	0.9486	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1155.6593	947.9766	951.3502	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	265.3394	378.3478	282.1746	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	66.3349	94.5870	70.5437	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												231.4655	(107)
Energy for space heating												27.5941	(99)
Energy for space cooling												1.4500	(108)
Total												29.0441	(109)
Fabric Energy Efficiency (DFEE)												29.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)

Opening Type 3			1.2500	1.1450	1.4313		(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000 (28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000 (29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000 (30)
Total net area of external elements Aum(A, m2)			232.3500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688		(33)
Main dwelling							
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000 (32)
Internal Wall 1			112.0000			9.0000	1008.0000 (32c)
Internal Ceiling 1			60.6500			9.0000	545.8500 (32e)
Internal Ceiling 2			60.6500			9.0000	545.8500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2											(98c) / (4) =	25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8314.7544	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			449.9735	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7916	(257)
SAP value		87.1677	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1717.3461	(272)
CO2 emissions per m2			10.7600	(273)
EI value			88.7541	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7376.6042	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			665.3087	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1520.3346	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8507.5952	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (7.8%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	B 91	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£553	£553	£0
Space heating	£380	£380	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£665	£435	£230
Total cost of uses	£666	£436	£230
Delivered energy	46 kWh/m²	41 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.4 tonnes	0.1 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	1 kg/m²
Primary energy	53 kWh/m²	45 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3741 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2										(98c) / (4) =		25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7461.5747	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			309.2842	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5441 (257)
SAP value		91.1799
SAP rating (Section 12)		91 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1603.2543	(272)
CO2 emissions per m2			10.0400	(273)
EI value			89.5012	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)											141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area													
	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house													
	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6491.3947	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			435.1542	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1401.9326	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			7184.8454	(286)

Full SAP Calculation Printout

Plot Reference	Plot 1	Issued on Date	05/11/2026
Assessment Reference	Lean	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	88 B	DER	10.34	TER	8.30
Environmental	90 B	% DER < TER			-24.58
CO_2 Emissions (t/year)	1.43	DFEE	26.25	TFEE	31.36
Compliance Check	See BREL	% DFEE < TFEE			16.30
% DPER < TPER	-33.43	DPER	57.71	TPER	43.25

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)

Average = Sum(39)m / 12 = 127.7343

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 4477.1386 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 88.2000
Water heating fuel used 3092.2959 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7999.9125	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1651.2293	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9211.9336	(286)
Dwelling Primary energy Rate (DPER)			57.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400	19.6403	0.6300	0.7000	0.7700				68.0663	(76)
West				5.7600	19.6403	0.6300	0.7000	0.7700				34.5734	(80)
North				0.2500	15.2954	0.6300	0.7000	1.0000				1.5177	(82)
South				1.0000	47.0123	0.6300	0.7000	1.0000				18.6592	(82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4813.0912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2768 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5623 0.5599 0.5575 0.5464 0.5443 0.5346 0.5346 0.5328 0.5383 0.5443 0.5485 0.5529 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												253.5180	(107)
Energy for space heating												24.6606	(99)
Energy for space cooling												1.5882	(108)
Total												26.2487	(109)
Fabric Energy Efficiency (DFEE)												26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)

Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7749.5719	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			429.4008	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7554	(257)
SAP value		87.7544	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1598.6578	(272)
CO2 emissions per m2			10.0100	(273)
EI value			89.5313	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6929.2104	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			636.9439	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1426.3819	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8002.0403	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (8.3%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£637	£407	£230
Total cost of uses	£637	£407	£230
Delivered energy	43 kWh/m²	38 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.3 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	50 kWh/m²	42 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2										(98c) / (4) =		22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6896.3923	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			288.7115	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5079	(257)
SAP value		91.7666	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1484.5660	(272)
CO2 emissions per m2			9.3000	(273)
EI value			90.2785	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	54.0265	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484	(42)
Hot water usage for mixer showers	73.6546 72.5477 70.9347 67.8487 65.5712 63.0314 61.5878 63.1885 64.9432 67.6702 70.8226	73.3724	(42a)
Hot water usage for baths	33.4706 32.9735 32.2735 30.9829 30.0164 28.9448 28.3660 29.0611 29.8179 30.9646 32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836 45.4678 43.7521 42.0363 40.3205 38.6048 38.6048 40.3205 42.0363 43.7521 45.4678	47.1836	(42c)
Average daily hot water use (litres/day)		141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6044.0010	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			406.7894	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1307.9799	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6679.2905	(286)

Full SAP Calculation Printout

Plot Reference	Plot 1	**Issued on Date**	05/11/2026
Assessment Reference	Green	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	97 A	**DER**	7.55	**TER**	8.30
Environmental	92 A	**% DER < TER**			9.04
CO_2 Emissions (t/year)	0.96	**DFEE**	26.25	**TFEE**	31.36
Compliance Check	See BREL	**% DFEE < TFEE**			16.30
% DPER < TPER	8.82	**DPER**	39.43	**TPER**	43.25

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4477.1386 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.2959 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -3454.4788 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4545.4337	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1205.2802	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	1.4985	-1911.9450	
PV Unit electricity exported	-2178.5650	0.4614	-1005.2333	
Total			-2917.1783	(283)
Total Primary energy kWh/year			6294.7553	(286)
Dwelling Primary energy Rate (DPER)			39.4300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
										Total per year (kWh/year) = Sum(64)m =		2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4813.0912	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2768	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff													
	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day)	70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
								Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)											991	(64)
Electric shower(s)												

	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area													
	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house													
	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	253.5180	(107)
Energy for space heating	24.6606	(99)
Energy for space cooling	1.5882	(108)
Total	26.2487	(109)
Fabric Energy Efficiency (DFEE)	26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3586	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	63.1329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)

Average = Sum(39)m / 12 =	138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses													
	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												70.2304	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)
Total internal gains												
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month													
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4295.0931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710	(257)
SAP value		97.2275	
SAP rating (Section 12)		97	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1152.7087	(272)
CO2 emissions per m2			7.2200	(273)
EI value			92.4516	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 402.9080 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	

Distribution loss (46)m = 0.15 x (45)m

36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)

Water storage loss (or HIU loss):
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153 (61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)

Total per year (kWh/year) = Sum(64)m = 2733.9853 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354 (71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	

Total	-469.7486 (269)
Total CO2, kg/year	956.6333 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 97
Current environmental impact rating: A 92

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Already installed
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 31	-152 kg (15.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£477	-£477	£0
Total cost of fuels	£160	£160	£0
Total cost of uses	£160	£160	£0
Delivered energy	21 kWh/m²	21 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	31 kWh/m²	31 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b)	- (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c)	- (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)

Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)	141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
											Total per year (kWh/year) = Sum(64)m =	2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction											fLA = Living area / (4) =	0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													

	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)												
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
Efficiency of water heater												88.2000 (216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734 (217)
Fuel for water heating, kWh/month												
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4226.6405 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	88.2000
Water heating fuel used	3092.4534 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	344.4780 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3454.4788 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4295.0931 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710 (257)
SAP value		97.2275
SAP rating (Section 12)		97 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)

Total CO2, kg/year	1152.7087 (272)
CO2 emissions per m2	7.2200 (273)
EI value	92.4516
EI rating	92 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)

Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	
Total			-469.7486	(269)
Total CO2, kg/year			956.6333	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)

Full SAP Calculation Printout

Plot Reference	Plot 2	**Issued on Date**	05/11/2026
Assessment Reference	Baseline	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	88 B	**DER**	10.09	**TER**	7.43
Environmental	90 B	**% DER < TER**			-35.80
CO_2 Emissions (t/year)	1.39	**DFEE**	25.31	**TFEE**	27.50
Compliance Check	See BREL	**% DFEE < TFEE**			7.96
% DPER < TPER	-46.00	**DPER**	56.35	**TPER**	38.60

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9978	0.9933	0.9779	0.9080	0.7489	0.5386	0.3911	0.4427	0.7138	0.9548	0.9941	0.9984	(86)
MIT	20.1902	20.3307	20.5296	20.7752	20.9086	20.9465	20.9505	20.9501	20.9275	20.7262	20.4163	20.1733	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9972	0.9914	0.9717	0.8856	0.7032	0.4803	0.3275	0.3743	0.6511	0.9387	0.9922	0.9979	(89)
MIT 2	19.2871	19.4683	19.7213	20.0276	20.1725	20.2149	20.2175	20.2191	20.1976	19.9775	19.5871	19.2729	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4644	19.6375	19.8800	20.1743	20.3170	20.3585	20.3613	20.3625	20.3408	20.1244	19.7499	19.4496	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4644	19.6375	19.8800	20.1743	20.3170	20.3585	20.3613	20.3625	20.3408	20.1244	19.7499	19.4496	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9894	0.9679	0.8823	0.7062	0.4867	0.3346	0.3820	0.6569	0.9348	0.9904	0.9972	(94)
Useful gains	852.4189	1003.0954	1120.4406	1182.0765	1024.9729	702.7740	461.2869	484.3602	747.5545	899.1785	841.4982	811.4528	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1934.6569	1873.9492	1695.7621	1406.8733	1072.1242	706.6723	461.5841	485.0266	769.9561	1185.0297	1583.2482	1920.4178	(97)
Space heating kWh	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98a)
Space heating requirement - total per year (kWh/year)												3587.1755	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3587.1755	
Space heating per m2											(98c) / (4) =	22.4718	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	961.9893	699.1801	511.3969	193.3736	41.9122	0.0000	0.0000	0.0000	0.0000	254.0900	638.0646	985.7466	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5717	88.5523	88.5113	88.4091	88.2698	88.2000	88.2000	88.2000	88.2000	88.4421	88.5431	88.5751	(217)
Fuel for water heating, kWh/month	312.1805	275.5648	291.4844	253.2849	243.6620	217.2877	212.6934	222.5219	226.4890	254.7805	274.1591	308.3333	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4285.7533 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.4413 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7808.6726	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4285.7533	0.2100	900.0082	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4413	0.2100	649.4127	(264)
Space and water heating			1549.4209	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1611.0690	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4285.7533	1.1300	4842.9013	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4413	1.1300	3494.4587	(278)
Space and water heating			8337.3599	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8995.8326	(286)
Dwelling Primary energy Rate (DPER)			56.3500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			180.3000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053	(33)
Main dwelling						
Party Wall 1			102.8000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400		19.6403		0.6300		0.7000		0.7700	68.0663 (76)
West				5.7600		19.6403		0.6300		0.7000		0.7700	34.5734 (80)
North				0.2500		15.2954		0.6300		0.7000		1.0000	1.5177 (82)
South				1.0000		47.0123		0.6300		0.7000		1.0000	18.6592 (82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)	
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4148.5049	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2969 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5716 0.5689 0.5661 0.5533 0.5509 0.5398 0.5398 0.5377 0.5441 0.5509 0.5558 0.5608 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	126.1773	125.8074	125.4448	123.7419	123.4232	121.9400	121.9400	121.6654	122.5113	123.4232	124.0678	124.7417	(39)
Average = Sum(39)m / 12 =												123.7403	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7904	0.7881	0.7858	0.7752	0.7732	0.7639	0.7639	0.7622	0.7675	0.7732	0.7772	0.7814	(40)
HLP (average)												0.7752	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9584	78.1876	78.4136	79.4928	79.6980	80.6674	80.6674	80.8495	80.2912	79.6980	79.2839	78.8556	
alpha	6.1972	6.2125	6.2276	6.2995	6.3132	6.3778	6.3778	6.3900	6.3527	6.3132	6.2856	6.2570	
util living area	0.9986	0.9953	0.9828	0.9198	0.7648	0.5511	0.4001	0.4549	0.7329	0.9642	0.9960	0.9990	(86)
MIT	19.9506	20.1392	20.4085	20.7479	20.9386	20.9933	20.9992	20.9984	20.9648	20.6750	20.2521	19.9255	(87)
Th 2	20.2616	20.2636	20.2656	20.2749	20.2766	20.2847	20.2847	20.2862	20.2816	20.2766	20.2731	20.2694	(88)
util rest of house	0.9982	0.9939	0.9778	0.8993	0.7198	0.4920	0.3354	0.3852	0.6706	0.9508	0.9947	0.9987	(89)
MIT 2	19.2860	19.4754	19.7431	20.0734	20.2362	20.2816	20.2845	20.2857	20.2623	20.0131	19.5962	19.2673	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4164	19.6057	19.8737	20.2057	20.3741	20.4213	20.4248	20.4256	20.4002	20.1431	19.7249	19.3965	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4164	19.6057	19.8737	20.2057	20.3741	20.4213	20.4248	20.4256	20.4002	20.1431	19.7249	19.3965	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9923	0.9746	0.8971	0.7261	0.5034	0.3481	0.3989	0.6814	0.9478	0.9933	0.9982	(94)
Useful gains	785.1624	939.4939	1066.0848	1151.8326	1016.7313	705.2277	466.0298	488.9360	744.8987	861.1034	783.4761	744.9473	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1907.3483	1850.0836	1677.6618	1398.9940	1070.5798	709.8441	466.3948	489.7738	771.8412	1177.8345	1566.3468	1895.6361	(97)
Space heating kWh	834.9063	611.9163	455.0132	177.9562	40.0633	0.0000	0.0000	0.0000	0.0000	235.6480	563.6669	856.1125	(98a)
Space heating requirement - total per year (kWh/year)												3775.2826	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	834.9063	611.9163	455.0132	177.9562	40.0633	0.0000	0.0000	0.0000	0.0000	235.6480	563.6669	856.1125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3775.2826	
Space heating per m2											(98c) / (4) =	23.6502	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1146.2362	902.3562	924.6567	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9541	0.9815	0.9680	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1093.6460	885.6681	895.0855	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	309.9890	424.7054	324.0355	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	77.4973	106.1763	81.0089	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												264.6825	(107)
Energy for space heating												23.6502	(99)
Energy for space cooling												1.6581	(108)
Total												25.3083	(109)
Fabric Energy Efficiency (DFEE)												25.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3586	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)

Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9484	(42)
Hot water usage for mixer showers												
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths												
33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses												
47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9966	0.9914	0.9723	0.8997	0.7410	0.5384	0.3908	0.4410	0.7084	0.9474	0.9922	0.9975	(86)
MIT	20.2327	20.3585	20.5585	20.7862	20.9109	20.9465	20.9505	20.9501	20.9285	20.7417	20.4430	20.2126	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9956	0.9891	0.9649	0.8760	0.6952	0.4801	0.3272	0.3729	0.6457	0.9293	0.9897	0.9968	(89)
MIT 2	19.3413	19.5034	19.7570	20.0398	20.1747	20.2149	20.2175	20.2191	20.1983	19.9954	19.6209	19.3231	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9867	0.9607	0.8730	0.6983	0.4865	0.3344	0.3806	0.6515	0.9255	0.9875	0.9958	(94)
Useful gains	923.0455	1048.6841	1166.5136	1198.2207	1028.0214	702.7849	461.2884	484.3760	748.6167	922.4815	885.2394	876.8567	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1941.2762	1878.2347	1700.1140	1408.3604	1072.3943	706.6732	461.5842	485.0281	770.0501	1187.1957	1587.3042	1926.4742	(97)
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98a)
Space heating requirement - total per year (kWh/year)												3379.6837	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3379.6837	
Space heating per m2											(98c) / (4) =	21.1720	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	905.0940	666.0191	474.3114	180.7653	39.4425	0.0000	0.0000	0.0000	0.0000	235.3015	603.9267	932.9933	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5657	88.5472	88.5024	88.4009	88.2662	88.2000	88.2000	88.2000	88.2000	88.4325	88.5372	88.5699	(217)
Fuel for water heating, kWh/month	312.2013	275.5807	291.5138	253.3082	243.6719	217.2877	212.6934	222.5219	226.4890	254.8081	274.1776	308.3515	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4037.8539	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.6049	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7560.9367	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.8539	3.6400	146.9779	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.6049	3.6400	112.5708	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			422.5345	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7434	(257)
SAP value		87.9502	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.8539	0.2100	847.9493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.6049	0.2100	649.4470	(264)
Space and water heating			1497.3963	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1559.0444	(272)
CO2 emissions per m2			9.7700	(273)
EI value			89.7907	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b)	x 2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c)	x 2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d)	x 2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3339	0.3180	0.3180	0.2941	0.2941	0.2623	0.2703	0.2544	0.2623	0.2782	0.2782	0.3021	(22b)
Effective ac	0.5557	0.5506	0.5506	0.5433	0.5433	0.5344	0.5365	0.5324	0.5344	0.5387	0.5387	0.5456	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.8908	73.2018	73.2018	72.2313	72.2313	71.0550	71.3365	70.7819	71.0550	71.6263	71.6263	72.5464	(38)
Heat transfer coeff	124.0627	123.3737	123.3737	122.4032	122.4032	121.2269	121.5083	120.9538	121.2269	121.7982	121.7982	122.7183	(39)
Average = Sum(39)m / 12 =												122.2373	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7772	0.7729	0.7729	0.7668	0.7668	0.7594	0.7612	0.7577	0.7594	0.7630	0.7630	0.7688	(40)
HLP (average)												0.7658	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.2872	79.7300	79.7300	80.3621	80.3621	81.1419	80.9540	81.3251	81.1419	80.7613	80.7613	80.1558	
alpha	6.2858	6.3153	6.3153	6.3575	6.3575	6.4095	6.3969	6.4217	6.4095	6.3841	6.3841	6.3437	
util living area	0.9948	0.9883	0.9600	0.8521	0.6454	0.4009	0.2630	0.2898	0.5791	0.9069	0.9862	0.9961	(86)
MIT	20.3355	20.4461	20.6462	20.8499	20.9360	20.9509	20.9514	20.9516	20.9457	20.8231	20.5498	20.3171	(87)
Th 2	20.2731	20.2769	20.2769	20.2822	20.2822	20.2886	20.2871	20.2901	20.2886	20.2855	20.2855	20.2805	(88)
util rest of house	0.9933	0.9850	0.9493	0.8203	0.5932	0.3442	0.2025	0.2256	0.5116	0.8772	0.9817	0.9950	(89)
MIT 2	19.4885	19.6319	19.8814	20.1230	20.2083	20.2262	20.2248	20.2280	20.2231	20.1021	19.7715	19.4712	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9823	0.9450	0.8195	0.5984	0.3506	0.2093	0.2328	0.5190	0.8752	0.9787	0.9937	(94)
Useful gains	940.0770	1049.4948	1150.2454	1144.0856	884.3955	529.1499	299.7975	310.8360	621.4088	898.4657	906.3645	889.8174	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1805.7035	1750.8832	1558.3947	1268.7893	899.8022	529.5676	299.8082	310.8566	626.1305	1052.7729	1452.3493	1783.9839	(97)
Space heating kWh	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98a)
Space heating requirement - total per year (kWh/year)												2693.4449	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2693.4449	
Space heating per m2											(98c) / (4) =	16.8730	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	769.4457	563.1219	362.7994	107.2720	13.6948	0.0000	0.0000	0.0000	0.0000	137.1619	469.6644	794.8147	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5492	88.5288	88.4696	88.3425	88.2252	88.2000	88.2000	88.2000	88.2000	88.3681	88.5084	88.5539	(217)
Fuel for water heating, kWh/month													
	312.2595	275.6378	291.6217	253.4757	243.7852	217.2877	212.6934	222.5219	226.4890	254.9936	274.2666	308.4072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3217.9747	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.4394	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6741.8921	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.9747	6.3400	204.0196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	6.3400	196.1241	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			625.0679	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.9747	0.2100	675.7747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.4394	0.2100	649.6223	(264)
Space and water heating			1325.3970	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1387.0450	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3217.9747	1.1300	3636.3115	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	1.1300	3495.5865	(278)
Space and water heating			7131.8979	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			7790.3706	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (8.5%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (11.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 91
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£513	£513	£0
Space heating	£339	£339	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£625	£395	£230
Total cost of uses	£625	£395	£230
Delivered energy	42 kWh/m²	37 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.3 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	49 kWh/m²	41 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3741 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9966	0.9914	0.9723	0.8997	0.7410	0.5384	0.3908	0.4410	0.7084	0.9474	0.9922	0.9975	(86)
MIT	20.2327	20.3585	20.5585	20.7862	20.9109	20.9465	20.9505	20.9501	20.9285	20.7417	20.4430	20.2126	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9956	0.9891	0.9649	0.8760	0.6952	0.4801	0.3272	0.3729	0.6457	0.9293	0.9897	0.9968	(89)
MIT 2	19.3413	19.5034	19.7570	20.0398	20.1747	20.2149	20.2175	20.2191	20.1983	19.9954	19.6209	19.3231	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9867	0.9607	0.8730	0.6983	0.4865	0.3344	0.3806	0.6515	0.9255	0.9875	0.9958	(94)
Useful gains	923.0455	1048.6841	1166.5136	1198.2207	1028.0214	702.7849	461.2884	484.3760	748.6167	922.4815	885.2394	876.8567	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1941.2762	1878.2347	1700.1140	1408.3604	1072.3943	706.6732	461.5842	485.0281	770.0501	1187.1957	1587.3042	1926.4742	(97)
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98a)
Space heating requirement - total per year (kWh/year)												3379.6837	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3379.6837	
Space heating per m2										(98c) / (4) =		21.1720	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	905.0940	666.0191	474.3114	180.7653	39.4425	0.0000	0.0000	0.0000	0.0000	235.3015	603.9267	932.9933	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5657	88.5472	88.5024	88.4009	88.2662	88.2000	88.2000	88.2000	88.2000	88.4325	88.5372	88.5699	(217)
Fuel for water heating, kWh/month	312.2013	275.5807	291.5138	253.3082	243.6719	217.2877	212.6934	222.5219	226.4890	254.8081	274.1776	308.3515	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4037.8539	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.6049	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6707.7571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.8539	3.6400	146.9779	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.6049	3.6400	112.5708	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			281.8452	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4958	(257)
SAP value		91.9624	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.8539	0.2100	847.9493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.6049	0.2100	649.4470	(264)
Space and water heating			1497.3963	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1444.9526	(272)
CO2 emissions per m2			9.0500	(273)
EI value			90.5379	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3339	0.3180	0.3180	0.2941	0.2941	0.2623	0.2703	0.2544	0.2623	0.2782	0.2782	0.3021	(22b)
Effective ac	0.5557	0.5506	0.5506	0.5433	0.5433	0.5344	0.5365	0.5324	0.5344	0.5387	0.5387	0.5456	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.8908	73.2018	73.2018	72.2313	72.2313	71.0550	71.3365	70.7819	71.0550	71.6263	71.6263	72.5464	(38)
Heat transfer coeff	124.0627	123.3737	123.3737	122.4032	122.4032	121.2269	121.5083	120.9538	121.2269	121.7982	121.7982	122.7183	(39)
Average = Sum(39)m / 12 =												122.2373	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7772	0.7729	0.7729	0.7668	0.7668	0.7594	0.7612	0.7577	0.7594	0.7630	0.7630	0.7688	(40)
HLP (average)												0.7658	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)											141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.2872	79.7300	79.7300	80.3621	80.3621	81.1419	80.9540	81.3251	81.1419	80.7613	80.7613	80.1558	
alpha	6.2858	6.3153	6.3153	6.3575	6.3575	6.4095	6.3969	6.4217	6.4095	6.3841	6.3841	6.3437	
util living area													
	0.9948	0.9883	0.9600	0.8521	0.6454	0.4009	0.2630	0.2898	0.5791	0.9069	0.9862	0.9961	(86)
MIT	20.3355	20.4461	20.6462	20.8499	20.9360	20.9509	20.9514	20.9516	20.9457	20.8231	20.5498	20.3171	(87)
Th 2	20.2731	20.2769	20.2769	20.2822	20.2822	20.2886	20.2871	20.2901	20.2886	20.2855	20.2855	20.2805	(88)
util rest of house													
	0.9933	0.9850	0.9493	0.8203	0.5932	0.3442	0.2025	0.2256	0.5116	0.8772	0.9817	0.9950	(89)
MIT 2	19.4885	19.6319	19.8814	20.1230	20.2083	20.2262	20.2248	20.2280	20.2231	20.1021	19.7715	19.4712	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9823	0.9450	0.8195	0.5984	0.3506	0.2093	0.2328	0.5190	0.8752	0.9787	0.9937	(94)
Useful gains	940.0770	1049.4948	1150.2454	1144.0856	884.3955	529.1499	299.7975	310.8360	621.4088	898.4657	906.3645	889.8174	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1805.7035	1750.8832	1558.3947	1268.7893	899.8022	529.5676	299.8082	310.8566	626.1305	1052.7729	1452.3493	1783.9839	(97)
Space heating kWh													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98a)
Space heating requirement - total per year (kWh/year)												2693.4449	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2693.4449	
Space heating per m2											(98c) / (4) =	16.8730	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	769.4457	563.1219	362.7994	107.2720	13.6948	0.0000	0.0000	0.0000	0.0000	137.1619	469.6644	794.8147	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5492	88.5288	88.4696	88.3425	88.2252	88.2000	88.2000	88.2000	88.2000	88.3681	88.5084	88.5539	(217)
Fuel for water heating, kWh/month													
	312.2595	275.6378	291.6217	253.4757	243.7852	217.2877	212.6934	222.5219	226.4890	254.9936	274.2666	308.4072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3217.9747	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.4394	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5856.6826	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.9747	6.3400	204.0196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	6.3400	196.1241	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			394.9135	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.9747	0.2100	675.7747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.4394	0.2100	649.6223	(264)
Space and water heating			1325.3970	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1268.6431	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3217.9747	1.1300	3636.3115	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	1.1300	3495.5865	(278)
Space and water heating			7131.8979	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6467.6207	(286)

Full SAP Calculation Printout

Plot Reference	Plot 2	Issued on Date	05/11/2026
Assessment Reference	Lean	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	88 B	DER	9.53	TER	7.43
Environmental	90 B	% DER < TER			-28.26
CO_2 Emissions (t/year)	1.32	DFEE	23.20	TFEE	27.50
Compliance Check	See BREL	% DFEE < TFEE			15.62
% DPER < TPER	-38.10	DPER	53.31	TPER	38.60

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9977	0.9926	0.9749	0.8954	0.7247	0.5162	0.3738	0.4236	0.6896	0.9486	0.9936	0.9983	(86)
MIT	20.2527	20.3908	20.5826	20.8094	20.9222	20.9500	20.9526	20.9523	20.9361	20.7598	20.4647	20.2323	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9970	0.9906	0.9682	0.8717	0.6801	0.4620	0.3154	0.3607	0.6292	0.9311	0.9915	0.9978	(89)
MIT 2	19.3972	19.5747	19.8178	20.0970	20.2175	20.2484	20.2500	20.2513	20.2358	20.0462	19.6765	19.3768	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9886	0.9644	0.8692	0.6836	0.4680	0.3220	0.3677	0.6351	0.9277	0.9897	0.9971	(94)
Useful gains	852.3121	1002.2973	1116.4336	1164.5278	992.1166	675.7873	443.8579	466.2414	722.7403	892.3101	840.9438	811.4009	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1845.1152	1788.3890	1619.3915	1346.5215	1025.7141	678.2609	444.0294	466.6419	738.4559	1135.9724	1515.7156	1835.7694	(97)
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98a)
Space heating requirement - total per year (kWh/year)												3226.3824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3226.3824	
Space heating per m2											(98c) / (4) =	20.2116	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	882.4917	631.1273	447.0737	156.5537	29.8645	0.0000	0.0000	0.0000	0.0000	216.5887	580.4488	910.5498	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5633	88.5414	88.4953	88.3839	88.2518	88.2000	88.2000	88.2000	88.2000	88.4222	88.5328	88.5675	(217)
Fuel for water heating, kWh/month	312.2101	275.5986	291.5372	253.3570	243.7117	217.2877	212.6934	222.5219	226.4890	254.8377	274.1912	308.3597	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 3854.6982 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.7950 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7377.9712	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3854.6982	0.2100	809.4866	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.7950	0.2100	649.4869	(264)
Space and water heating			1458.9736	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1520.6217	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.5300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3854.6982	1.1300	4355.8090	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.7950	1.1300	3494.8583	(278)
Space and water heating			7850.6673	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8509.1400	(286)
Dwelling Primary energy Rate (DPER)			53.3100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			180.3000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053	(33)
Main dwelling						
Party Wall 1			102.8000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400	19.6403	0.6300	0.7000	0.7700				68.0663	(76)
West				5.7600	19.6403	0.6300	0.7000	0.7700				34.5734	(80)
North				0.2500	15.2954	0.6300	0.7000	1.0000				1.5177	(82)
South				1.0000	47.0123	0.6300	0.7000	1.0000				18.6592	(82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4148.5049	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2544 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3243	0.3180	0.3116	0.2798	0.2735	0.2417	0.2417	0.2353	0.2544	0.2735	0.2862	0.2989	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5526 0.5506 0.5486 0.5392 0.5374 0.5292 0.5292 0.5277 0.5324 0.5374 0.5410 0.5447 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.4734	73.2018	72.9356	71.6853	71.4514	70.3624	70.3624	70.1608	70.7819	71.4514	71.9246	72.4194	(38)
Heat transfer coeff	119.6633	119.3917	119.1255	117.8752	117.6413	116.5523	116.5523	116.3507	116.9718	117.6413	118.1145	118.6093	(39)
Average = Sum(39)m / 12 =												117.8741	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7496	0.7479	0.7463	0.7384	0.7370	0.7301	0.7301	0.7289	0.7328	0.7370	0.7399	0.7430	(40)
HLP (average)												0.7384	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2022	82.3892	82.5733	83.4491	83.6151	84.3963	84.3963	84.5426	84.0936	83.6151	83.2800	82.9327	
alpha	6.4801	6.4926	6.5049	6.5633	6.5743	6.6264	6.6264	6.6362	6.6062	6.5743	6.5520	6.5288	
util living area	0.9986	0.9949	0.9806	0.9087	0.7414	0.5286	0.3827	0.4356	0.7094	0.9593	0.9957	0.9990	(86)
MIT	20.0284	20.2141	20.4750	20.7915	20.9551	20.9957	20.9996	20.9990	20.9746	20.7173	20.3123	19.9992	(87)
Th 2	20.2972	20.2987	20.3001	20.3070	20.3083	20.3143	20.3143	20.3154	20.3120	20.3083	20.3057	20.3030	(88)
util rest of house	0.9981	0.9934	0.9752	0.8869	0.6972	0.4736	0.3233	0.3713	0.6490	0.9448	0.9943	0.9987	(89)
MIT 2	19.3928	19.5789	19.8373	20.1417	20.2790	20.3122	20.3142	20.3151	20.2982	20.0803	19.6829	19.3683	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9919	0.9720	0.8856	0.7041	0.4843	0.3349	0.3840	0.6598	0.9422	0.9929	0.9982	(94)
Useful gains	785.1311	939.0435	1063.2829	1137.0751	985.8862	678.4439	448.3591	470.6299	721.3170	856.0508	783.1887	744.9405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1820.9788	1767.4212	1603.7202	1340.1483	1024.8580	681.4081	448.5720	471.1393	740.5396	1129.9848	1500.8161	1813.7917	(97)
Space heating kWh	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98a)
Space heating requirement - total per year (kWh/year)												3420.3575	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3420.3575	
Space heating per m2											(98c) / (4) =	21.4268	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1095.5920	862.4873	884.2651	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9871	0.9767	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1058.0077	851.3600	863.6548	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	335.6486	450.2306	347.4200	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	83.9121	112.5577	86.8550	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												283.3248	(107)
Energy for space heating												21.4268	(99)
Energy for space cooling												1.7749	(108)
Total												23.2017	(109)
Fabric Energy Efficiency (DFEE)												23.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3586	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3241 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)

Opening Type 3			1.2500	0.9615	1.2019		(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000 (28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000 (29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000 (30)
Total net area of external elements Aum(A, m2)			180.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178		(33)
Main dwelling							
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000 (32)
Internal Wall 1			112.0000			9.0000	1008.0000 (32c)
Internal Ceiling 1			60.6500			9.0000	545.8500 (32e)
Internal Ceiling 2			60.6500			9.0000	545.8500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2721 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484 (42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724 (42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575 (42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836 (42c)
Average daily hot water use (litres/day)												141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7133.8958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			406.9902	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7160	(257)
SAP value		88.3935	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1469.3658	(272)
CO2 emissions per m2			9.2000	(273)
EI value			90.3780	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)											Total = Sum(45)m =	2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	83.7000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6411.0272	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			604.0911	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1317.5634	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			7416.4933	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (9.0%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (11.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 91
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£492	£492	£0
Space heating	£318	£318	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£604	£374	£230
Total cost of uses	£604	£374	£230
Delivered energy	40 kWh/m²	35 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.2 tonnes	0.1 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	1 kg/m²
Primary energy	46 kWh/m²	38 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.2721	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		46.1899	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2										(98c) / (4) =		18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6280.7162	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			266.3009	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4685 (257)
SAP value		92.4057
SAP rating (Section 12)		92 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1355.2740	(272)
CO2 emissions per m2			8.4900	(273)
EI value			91.1251	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Main dwelling							
Ground floor	60.6500	(1b)	x 2.4000	(2b)	=	145.5600	(1b) - (3b)
First floor	60.6500	(1c)	x 2.6000	(2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300	(1d)	x 2.6000	(2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	46.1899	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484	(42)
Hot water usage for mixer showers	73.6546 72.5477 70.9347 67.8487 65.5712 63.0314 61.5878 63.1885 64.9432 67.6702 70.8226	73.3724	(42a)
Hot water usage for baths	33.4706 32.9735 32.2735 30.9829 30.0164 28.9448 28.3660 29.0611 29.8179 30.9646 32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836 45.4678 43.7521 42.0363 40.3205 38.6048 38.6048 40.3205 42.0363 43.7521 45.4678	47.1836	(42c)
Average daily hot water use (litres/day)		141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction											fLA = Living area / (4) =	0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5525.8177	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			373.9366	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1199.1615	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6093.7434	(286)

Full SAP Calculation Printout

Plot Reference	Plot 2	**Issued on Date**	05/11/2026
Assessment Reference	Green	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	98 A	**DER**	6.73	**TER**	7.43
Environmental	93 A	**% DER < TER**			9.42
CO_2 Emissions (t/year)	0.85	**DFEE**	23.20	**TFEE**	27.50
Compliance Check	See BREL	**% DFEE < TFEE**			15.62
% DPER < TPER	9.25	**DPER**	35.03	**TPER**	38.60

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9977	0.9926	0.9749	0.8954	0.7247	0.5162	0.3738	0.4236	0.6896	0.9486	0.9936	0.9983	(86)
MIT	20.2527	20.3908	20.5826	20.8094	20.9222	20.9500	20.9526	20.9523	20.9361	20.7598	20.4647	20.2323	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9970	0.9906	0.9682	0.8717	0.6801	0.4620	0.3154	0.3607	0.6292	0.9311	0.9915	0.9978	(89)
MIT 2	19.3972	19.5747	19.8178	20.0970	20.2175	20.2484	20.2500	20.2513	20.2358	20.0462	19.6765	19.3768	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9886	0.9644	0.8692	0.6836	0.4680	0.3220	0.3677	0.6351	0.9277	0.9897	0.9971	(94)
Useful gains	852.3121	1002.2973	1116.4336	1164.5278	992.1166	675.7873	443.8579	466.2414	722.7403	892.3101	840.9438	811.4009	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1845.1152	1788.3890	1619.3915	1346.5215	1025.7141	678.2609	444.0294	466.6419	738.4559	1135.9724	1515.7156	1835.7694	(97)
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98a)
Space heating requirement - total per year (kWh/year)												3226.3824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3226.3824	
Space heating per m2											(98c) / (4) =	20.2116	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	882.4917	631.1273	447.0737	156.5537	29.8645	0.0000	0.0000	0.0000	0.0000	216.5887	580.4488	910.5498	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5633	88.5414	88.4953	88.3839	88.2518	88.2000	88.2000	88.2000	88.2000	88.4222	88.5328	88.5675	(217)
Fuel for water heating, kWh/month	312.2101	275.5986	291.5372	253.3570	243.7117	217.2877	212.6934	222.5219	226.4890	254.8377	274.1912	308.3597	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 3854.6982 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.7950 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -3454.4788 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3923.4924	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3854.6982	0.2100	809.4866	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.7950	0.2100	649.4869	(264)
Space and water heating			1458.9736	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1074.6725	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.7300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3854.6982	1.1300	4355.8090	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.7950	1.1300	3494.8583	(278)
Space and water heating			7850.6673	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	1.4985	-1911.9450	
PV Unit electricity exported	-2178.5650	0.4614	-1005.2333	
Total			-2917.1783	(283)
Total Primary energy kWh/year			5591.9617	(286)
Dwelling Primary energy Rate (DPER)			35.0300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												138.1375	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4148.5049	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

													Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =													40.0000 / (5) =	0.0993 (8)
Pressure test														Yes
Pressure Test Method														Blower Door
Measured/design AP50														4.0000 (17)
Infiltration rate														0.2993 (18)
Number of sides sheltered														2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.2544 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3243	0.3180	0.3116	0.2798	0.2735	0.2417	0.2417	0.2353	0.2544	0.2735	0.2862	0.2989	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.4734	73.2018	72.9356	71.6853	71.4514	70.3624	70.3624	70.1608	70.7819	71.4514	71.9246	72.4194	(38)
Heat transfer coeff													
	119.6633	119.3917	119.1255	117.8752	117.6413	116.5523	116.5523	116.3507	116.9718	117.6413	118.1145	118.6093	(39)
Average = Sum(39)m / 12 =												117.8741	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7496	0.7479	0.7463	0.7384	0.7370	0.7301	0.7301	0.7289	0.7328	0.7370	0.7399	0.7430	(40)
HLP (average)												0.7384	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day)	70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	

Distribution loss (46)m = 0.15 x (45)m

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													

	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2022	82.3892	82.5733	83.4491	83.6151	84.3963	84.3963	84.5426	84.0936	83.6151	83.2800	82.9327	
alpha	6.4801	6.4926	6.5049	6.5633	6.5743	6.6264	6.6264	6.6362	6.6062	6.5743	6.5520	6.5288	
util living area													
	0.9986	0.9949	0.9806	0.9087	0.7414	0.5286	0.3827	0.4356	0.7094	0.9593	0.9957	0.9990	(86)
MIT	20.0284	20.2141	20.4750	20.7915	20.9551	20.9957	20.9996	20.9990	20.9746	20.7173	20.3123	19.9992	(87)
Th 2	20.2972	20.2987	20.3001	20.3070	20.3083	20.3143	20.3143	20.3154	20.3120	20.3083	20.3057	20.3030	(88)
util rest of house													
	0.9981	0.9934	0.9752	0.8869	0.6972	0.4736	0.3233	0.3713	0.6490	0.9448	0.9943	0.9987	(89)
MIT 2	19.3928	19.5789	19.8373	20.1417	20.2790	20.3122	20.3142	20.3151	20.2982	20.0803	19.6829	19.3683	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9919	0.9720	0.8856	0.7041	0.4843	0.3349	0.3840	0.6598	0.9422	0.9929	0.9982	(94)
Useful gains	785.1311	939.0435	1063.2829	1137.0751	985.8862	678.4439	448.3591	470.6299	721.3170	856.0508	783.1887	744.9405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1820.9788	1767.4212	1603.7202	1340.1483	1024.8580	681.4081	448.5720	471.1393	740.5396	1129.9848	1500.8161	1813.7917	(97)
Space heating kWh													
	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98a)
Space heating requirement - total per year (kWh/year)												3420.3575	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3420.3575	
Space heating per m2											(98c) / (4) =	21.4268	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1095.5920	862.4873	884.2651	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9871	0.9767	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1058.0077	851.3600	863.6548	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6486	450.2306	347.4200	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9121	112.5577	86.8550	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	283.3248	(107)
Energy for space heating	21.4268	(99)
Energy for space cooling	1.7749	(108)
Total	23.2017	(109)
Fabric Energy Efficiency (DFEE)	23.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3586	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses													
	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												70.2304	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh													
	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3679.4170	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			74.8103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1316	(257)
SAP value		97.8666	
SAP rating (Section 12)		98	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1023.4167	(272)
CO2 emissions per m2			6.4100	(273)
EI value			93.2983	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 402.9080 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)											Total = Sum(45)m =	2355.8227	

Distribution loss (46)m = 0.15 x (45)m

36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)

Water storage loss (or HIU loss):
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153 (61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)

Total per year (kWh/year) = Sum(64)m = 2733.9853 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354 (71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)

Space heating requirement - total per year (kWh/year) 2416.2189

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976 (98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2416.2189

Space heating per m2 (98c) / (4) = 15.1364 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2762.7079	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			126.6917	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	

Total		-469.7486 (269)
Total CO2, kg/year		847.8148 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4373.2980	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 98
Current environmental impact rating: A 93

N Solar water heating	SAP increase too small	
U Solar photovoltaic panels	Already installed	
V2 Wind turbine	Not applicable	

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 31	-152 kg (18.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 98
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£492	£492	£0
Space heating	£318	£318	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£477	-£477	£0
Total cost of fuels	£127	£127	£0
Total cost of uses	£127	£127	£0
Delivered energy	17 kWh/m²	17 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	27 kWh/m²	27 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b)	- (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c)	- (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)

Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
											Total per year (kWh/year) = Sum(64)m =	2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area													
	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house													
	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)													

	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)												
	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
Efficiency of water heater												88.2000 (216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616 (217)
Fuel for water heating, kWh/month												
	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3679.4170	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			74.8103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.1316	(257)
SAP value	97.8666	
SAP rating (Section 12)	98	(258)
SAP band	A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)

Total CO2, kg/year	1023.4167 (272)
CO2 emissions per m2	6.4100 (273)
EI value	93.2983
EI rating	93 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2762.7079	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)

Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			126.6917	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	
Total			-469.7486	(269)
Total CO2, kg/year			847.8148	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4373.2980	(286)

Full SAP Calculation Printout

Plot Reference	Plot 3	Issued on Date	05/11/2026
Assessment Reference	Baseline	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	88 B	DER	10.09	TER	7.43
Environmental	90 B	% DER < TER			-35.80
CO_2 Emissions (t/year)	1.39	DFEE	25.31	TFEE	27.50
Compliance Check	See BREL	% DFEE < TFEE			7.96
% DPER < TPER	-46.00	DPER	56.35	TPER	38.60

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9978	0.9933	0.9779	0.9080	0.7489	0.5386	0.3911	0.4427	0.7138	0.9548	0.9941	0.9984	(86)
MIT	20.1902	20.3307	20.5296	20.7752	20.9086	20.9465	20.9505	20.9501	20.9275	20.7262	20.4163	20.1733	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9972	0.9914	0.9717	0.8856	0.7032	0.4803	0.3275	0.3743	0.6511	0.9387	0.9922	0.9979	(89)
MIT 2	19.2871	19.4683	19.7213	20.0276	20.1725	20.2149	20.2175	20.2191	20.1976	19.9775	19.5871	19.2729	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4644	19.6375	19.8800	20.1743	20.3170	20.3585	20.3613	20.3625	20.3408	20.1244	19.7499	19.4496	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4644	19.6375	19.8800	20.1743	20.3170	20.3585	20.3613	20.3625	20.3408	20.1244	19.7499	19.4496	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9894	0.9679	0.8823	0.7062	0.4867	0.3346	0.3820	0.6569	0.9348	0.9904	0.9972	(94)
Useful gains	852.4189	1003.0954	1120.4406	1182.0765	1024.9729	702.7740	461.2869	484.3602	747.5545	899.1785	841.4982	811.4528	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1934.6569	1873.9492	1695.7621	1406.8733	1072.1242	706.6723	461.5841	485.0266	769.9561	1185.0297	1583.2482	1920.4178	(97)
Space heating kWh	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98a)
Space heating requirement - total per year (kWh/year)												3587.1755	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3587.1755	
Space heating per m2											(98c) / (4) =	22.4718	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	805.1851	585.2138	428.0392	161.8537	35.0805	0.0000	0.0000	0.0000	0.0000	212.6733	534.0600	825.0699	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	961.9893	699.1801	511.3969	193.3736	41.9122	0.0000	0.0000	0.0000	0.0000	254.0900	638.0646	985.7466	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5717	88.5523	88.5113	88.4091	88.2698	88.2000	88.2000	88.2000	88.2000	88.4421	88.5431	88.5751	(217)
Fuel for water heating, kWh/month	312.1805	275.5648	291.4844	253.2849	243.6620	217.2877	212.6934	222.5219	226.4890	254.7805	274.1591	308.3333	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4285.7533 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.4413 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7808.6726	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4285.7533	0.2100	900.0082	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4413	0.2100	649.4127	(264)
Space and water heating			1549.4209	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1611.0690	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4285.7533	1.1300	4842.9013	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4413	1.1300	3494.4587	(278)
Space and water heating			8337.3599	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8995.8326	(286)
Dwelling Primary energy Rate (DPER)			56.3500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			180.3000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053	(33)
Main dwelling						
Party Wall 1			102.8000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400		19.6403		0.6300		0.7000		0.7700	68.0663 (76)
West				5.7600		19.6403		0.6300		0.7000		0.7700	34.5734 (80)
North				0.2500		15.2954		0.6300		0.7000		1.0000	1.5177 (82)
South				1.0000		47.0123		0.6300		0.7000		1.0000	18.6592 (82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)	
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4148.5049	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2969 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5716 0.5689 0.5661 0.5533 0.5509 0.5398 0.5398 0.5377 0.5441 0.5509 0.5558 0.5608 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	126.1773	125.8074	125.4448	123.7419	123.4232	121.9400	121.9400	121.6654	122.5113	123.4232	124.0678	124.7417	(39)
Average = Sum(39)m / 12 =												123.7403	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7904	0.7881	0.7858	0.7752	0.7732	0.7639	0.7639	0.7622	0.7675	0.7732	0.7772	0.7814	(40)
HLP (average)												0.7752	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.9584	78.1876	78.4136	79.4928	79.6980	80.6674	80.6674	80.8495	80.2912	79.6980	79.2839	78.8556	
alpha	6.1972	6.2125	6.2276	6.2995	6.3132	6.3778	6.3778	6.3900	6.3527	6.3132	6.2856	6.2570	
util living area	0.9986	0.9953	0.9828	0.9198	0.7648	0.5511	0.4001	0.4549	0.7329	0.9642	0.9960	0.9990	(86)
MIT	19.9506	20.1392	20.4085	20.7479	20.9386	20.9933	20.9992	20.9984	20.9648	20.6750	20.2521	19.9255	(87)
Th 2	20.2616	20.2636	20.2656	20.2749	20.2766	20.2847	20.2847	20.2862	20.2816	20.2766	20.2731	20.2694	(88)
util rest of house	0.9982	0.9939	0.9778	0.8993	0.7198	0.4920	0.3354	0.3852	0.6706	0.9508	0.9947	0.9987	(89)
MIT 2	19.2860	19.4754	19.7431	20.0734	20.2362	20.2816	20.2845	20.2857	20.2623	20.0131	19.5962	19.2673	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4164	19.6057	19.8737	20.2057	20.3741	20.4213	20.4248	20.4256	20.4002	20.1431	19.7249	19.3965	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4164	19.6057	19.8737	20.2057	20.3741	20.4213	20.4248	20.4256	20.4002	20.1431	19.7249	19.3965	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9923	0.9746	0.8971	0.7261	0.5034	0.3481	0.3989	0.6814	0.9478	0.9933	0.9982	(94)
Useful gains	785.1624	939.4939	1066.0848	1151.8326	1016.7313	705.2277	466.0298	488.9360	744.8987	861.1034	783.4761	744.9473	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1907.3483	1850.0836	1677.6618	1398.9940	1070.5798	709.8441	466.3948	489.7738	771.8412	1177.8345	1566.3468	1895.6361	(97)
Space heating kWh	834.9063	611.9163	455.0132	177.9562	40.0633	0.0000	0.0000	0.0000	0.0000	235.6480	563.6669	856.1125	(98a)
Space heating requirement - total per year (kWh/year)												3775.2826	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	834.9063	611.9163	455.0132	177.9562	40.0633	0.0000	0.0000	0.0000	0.0000	235.6480	563.6669	856.1125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3775.2826	
Space heating per m2											(98c) / (4) =	23.6502	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1146.2362	902.3562	924.6567	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9541	0.9815	0.9680	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1093.6460	885.6681	895.0855	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	309.9890	424.7054	324.0355	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	77.4973	106.1763	81.0089	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												264.6825	(107)
Energy for space heating												23.6502	(99)
Energy for space cooling												1.6581	(108)
Total												25.3083	(109)
Fabric Energy Efficiency (DFEE)												25.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3586	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)

Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9484	(42)
Hot water usage for mixer showers												
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths												
33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses												
47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9966	0.9914	0.9723	0.8997	0.7410	0.5384	0.3908	0.4410	0.7084	0.9474	0.9922	0.9975	(86)
MIT	20.2327	20.3585	20.5585	20.7862	20.9109	20.9465	20.9505	20.9501	20.9285	20.7417	20.4430	20.2126	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9956	0.9891	0.9649	0.8760	0.6952	0.4801	0.3272	0.3729	0.6457	0.9293	0.9897	0.9968	(89)
MIT 2	19.3413	19.5034	19.7570	20.0398	20.1747	20.2149	20.2175	20.2191	20.1983	19.9954	19.6209	19.3231	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9867	0.9607	0.8730	0.6983	0.4865	0.3344	0.3806	0.6515	0.9255	0.9875	0.9958	(94)
Useful gains	923.0455	1048.6841	1166.5136	1198.2207	1028.0214	702.7849	461.2884	484.3760	748.6167	922.4815	885.2394	876.8567	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1941.2762	1878.2347	1700.1140	1408.3604	1072.3943	706.6732	461.5842	485.0281	770.0501	1187.1957	1587.3042	1926.4742	(97)
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98a)
Space heating requirement - total per year (kWh/year)												3379.6837	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3379.6837	
Space heating per m2											(98c) / (4) =	21.1720	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	905.0940	666.0191	474.3114	180.7653	39.4425	0.0000	0.0000	0.0000	0.0000	235.3015	603.9267	932.9933	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5657	88.5472	88.5024	88.4009	88.2662	88.2000	88.2000	88.2000	88.2000	88.4325	88.5372	88.5699	(217)
Fuel for water heating, kWh/month	312.2013	275.5807	291.5138	253.3082	243.6719	217.2877	212.6934	222.5219	226.4890	254.8081	274.1776	308.3515	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4037.8539	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.6049	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7560.9367	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.8539	3.6400	146.9779	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.6049	3.6400	112.5708	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			422.5345	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7434	(257)
SAP value		87.9502	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.8539	0.2100	847.9493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.6049	0.2100	649.4470	(264)
Space and water heating			1497.3963	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1559.0444	(272)
CO2 emissions per m2			9.7700	(273)
EI value			89.7907	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b)	x 2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c)	x 2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d)	x 2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3339	0.3180	0.3180	0.2941	0.2941	0.2623	0.2703	0.2544	0.2623	0.2782	0.2782	0.3021	(22b)
Effective ac	0.5557	0.5506	0.5506	0.5433	0.5433	0.5344	0.5365	0.5324	0.5344	0.5387	0.5387	0.5456	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.8908	73.2018	73.2018	72.2313	72.2313	71.0550	71.3365	70.7819	71.0550	71.6263	71.6263	72.5464	(38)
Heat transfer coeff	124.0627	123.3737	123.3737	122.4032	122.4032	121.2269	121.5083	120.9538	121.2269	121.7982	121.7982	122.7183	(39)
Average = Sum(39)m / 12 =												122.2373	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7772	0.7729	0.7729	0.7668	0.7668	0.7594	0.7612	0.7577	0.7594	0.7630	0.7630	0.7688	(40)
HLP (average)												0.7658	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.2872	79.7300	79.7300	80.3621	80.3621	81.1419	80.9540	81.3251	81.1419	80.7613	80.7613	80.1558	
alpha	6.2858	6.3153	6.3153	6.3575	6.3575	6.4095	6.3969	6.4217	6.4095	6.3841	6.3841	6.3437	
util living area	0.9948	0.9883	0.9600	0.8521	0.6454	0.4009	0.2630	0.2898	0.5791	0.9069	0.9862	0.9961	(86)
MIT	20.3355	20.4461	20.6462	20.8499	20.9360	20.9509	20.9514	20.9516	20.9457	20.8231	20.5498	20.3171	(87)
Th 2	20.2731	20.2769	20.2769	20.2822	20.2822	20.2886	20.2871	20.2901	20.2886	20.2855	20.2855	20.2805	(88)
util rest of house	0.9933	0.9850	0.9493	0.8203	0.5932	0.3442	0.2025	0.2256	0.5116	0.8772	0.9817	0.9950	(89)
MIT 2	19.4885	19.6319	19.8814	20.1230	20.2083	20.2262	20.2248	20.2280	20.2231	20.1021	19.7715	19.4712	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9823	0.9450	0.8195	0.5984	0.3506	0.2093	0.2328	0.5190	0.8752	0.9787	0.9937	(94)
Useful gains	940.0770	1049.4948	1150.2454	1144.0856	884.3955	529.1499	299.7975	310.8360	621.4088	898.4657	906.3645	889.8174	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1805.7035	1750.8832	1558.3947	1268.7893	899.8022	529.5676	299.8082	310.8566	626.1305	1052.7729	1452.3493	1783.9839	(97)
Space heating kWh	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98a)
Space heating requirement - total per year (kWh/year)												2693.4449	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2693.4449	
Space heating per m2											(98c) / (4) =	16.8730	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	769.4457	563.1219	362.7994	107.2720	13.6948	0.0000	0.0000	0.0000	0.0000	137.1619	469.6644	794.8147	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5492	88.5288	88.4696	88.3425	88.2252	88.2000	88.2000	88.2000	88.2000	88.3681	88.5084	88.5539	(217)
Fuel for water heating, kWh/month													
	312.2595	275.6378	291.6217	253.4757	243.7852	217.2877	212.6934	222.5219	226.4890	254.9936	274.2666	308.4072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3217.9747	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.4394	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6741.8921	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.9747	6.3400	204.0196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	6.3400	196.1241	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			625.0679	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.9747	0.2100	675.7747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.4394	0.2100	649.6223	(264)
Space and water heating			1325.3970	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1387.0450	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3217.9747	1.1300	3636.3115	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	1.1300	3495.5865	(278)
Space and water heating			7131.8979	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			7790.3706	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (8.5%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (11.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 91
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£513	£513	£0
Space heating	£339	£339	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£625	£395	£230
Total cost of uses	£625	£395	£230
Delivered energy	42 kWh/m²	37 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.3 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	49 kWh/m²	41 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3741 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4054	0.3975	0.3895	0.3498	0.3418	0.3021	0.3021	0.2941	0.3180	0.3418	0.3577	0.3736	(22b)
Effective ac	0.5822	0.5790	0.5759	0.5612	0.5584	0.5456	0.5456	0.5433	0.5506	0.5584	0.5640	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.4073	76.9829	76.5670	74.6134	74.2479	72.5464	72.5464	72.2313	73.2018	74.2479	74.9873	75.7604	(38)
Heat transfer coeff	127.5791	127.1548	126.7389	124.7853	124.4198	122.7183	122.7183	122.4032	123.3737	124.4198	125.1592	125.9323	(39)
Average = Sum(39)m / 12 =												124.7836	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7992	0.7966	0.7940	0.7817	0.7794	0.7688	0.7688	0.7668	0.7729	0.7794	0.7841	0.7889	(40)
HLP (average)												0.7817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1018	77.3591	77.6130	78.8281	79.0596	80.1558	80.1558	80.3621	79.7300	79.0596	78.5926	78.1101	
alpha	6.1401	6.1573	6.1742	6.2552	6.2706	6.3437	6.3437	6.3575	6.3153	6.2706	6.2395	6.2073	
util living area	0.9966	0.9914	0.9723	0.8997	0.7410	0.5384	0.3908	0.4410	0.7084	0.9474	0.9922	0.9975	(86)
MIT	20.2327	20.3585	20.5585	20.7862	20.9109	20.9465	20.9505	20.9501	20.9285	20.7417	20.4430	20.2126	(87)
Th 2	20.2540	20.2563	20.2586	20.2692	20.2712	20.2805	20.2805	20.2822	20.2769	20.2712	20.2672	20.2630	(88)
util rest of house	0.9956	0.9891	0.9649	0.8760	0.6952	0.4801	0.3272	0.3729	0.6457	0.9293	0.9897	0.9968	(89)
MIT 2	19.3413	19.5034	19.7570	20.0398	20.1747	20.2149	20.2175	20.2191	20.1983	19.9954	19.6209	19.3231	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5163	19.6712	19.9143	20.1863	20.3192	20.3585	20.3613	20.3625	20.3416	20.1419	19.7823	19.4977	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9867	0.9607	0.8730	0.6983	0.4865	0.3344	0.3806	0.6515	0.9255	0.9875	0.9958	(94)
Useful gains	923.0455	1048.6841	1166.5136	1198.2207	1028.0214	702.7849	461.2884	484.3760	748.6167	922.4815	885.2394	876.8567	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1941.2762	1878.2347	1700.1140	1408.3604	1072.3943	706.6732	461.5842	485.0281	770.0501	1187.1957	1587.3042	1926.4742	(97)
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98a)
Space heating requirement - total per year (kWh/year)												3379.6837	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3379.6837	
Space heating per m2										(98c) / (4) =		21.1720	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	757.5636	557.4580	396.9987	151.3006	33.0134	0.0000	0.0000	0.0000	0.0000	196.9473	505.4866	780.9154	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	905.0940	666.0191	474.3114	180.7653	39.4425	0.0000	0.0000	0.0000	0.0000	235.3015	603.9267	932.9933	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5657	88.5472	88.5024	88.4009	88.2662	88.2000	88.2000	88.2000	88.2000	88.4325	88.5372	88.5699	(217)
Fuel for water heating, kWh/month	312.2013	275.5807	291.5138	253.3082	243.6719	217.2877	212.6934	222.5219	226.4890	254.8081	274.1776	308.3515	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4037.8539	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.6049	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6707.7571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.8539	3.6400	146.9779	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.6049	3.6400	112.5708	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			281.8452	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4958	(257)
SAP value		91.9624	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.8539	0.2100	847.9493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.6049	0.2100	649.4470	(264)
Space and water heating			1497.3963	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1444.9526	(272)
CO2 emissions per m2			9.0500	(273)
EI value			90.5379	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3180	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3339	0.3180	0.3180	0.2941	0.2941	0.2623	0.2703	0.2544	0.2623	0.2782	0.2782	0.3021	(22b)
Effective ac	0.5557	0.5506	0.5506	0.5433	0.5433	0.5344	0.5365	0.5324	0.5344	0.5387	0.5387	0.5456	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8998			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.1719 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.8908	73.2018	73.2018	72.2313	72.2313	71.0550	71.3365	70.7819	71.0550	71.6263	71.6263	72.5464	(38)
Heat transfer coeff	124.0627	123.3737	123.3737	122.4032	122.4032	121.2269	121.5083	120.9538	121.2269	121.7982	121.7982	122.7183	(39)
Average = Sum(39)m / 12 =												122.2373	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7772	0.7729	0.7729	0.7668	0.7668	0.7594	0.7612	0.7577	0.7594	0.7630	0.7630	0.7688	(40)
HLP (average)												0.7658	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)											141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.2872	79.7300	79.7300	80.3621	80.3621	81.1419	80.9540	81.3251	81.1419	80.7613	80.7613	80.1558	
alpha	6.2858	6.3153	6.3153	6.3575	6.3575	6.4095	6.3969	6.4217	6.4095	6.3841	6.3841	6.3437	
util living area													
	0.9948	0.9883	0.9600	0.8521	0.6454	0.4009	0.2630	0.2898	0.5791	0.9069	0.9862	0.9961	(86)
MIT	20.3355	20.4461	20.6462	20.8499	20.9360	20.9509	20.9514	20.9516	20.9457	20.8231	20.5498	20.3171	(87)
Th 2	20.2731	20.2769	20.2769	20.2822	20.2822	20.2886	20.2871	20.2901	20.2886	20.2855	20.2855	20.2805	(88)
util rest of house													
	0.9933	0.9850	0.9493	0.8203	0.5932	0.3442	0.2025	0.2256	0.5116	0.8772	0.9817	0.9950	(89)
MIT 2	19.4885	19.6319	19.8814	20.1230	20.2083	20.2262	20.2248	20.2280	20.2231	20.1021	19.7715	19.4712	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6548	19.7917	20.0315	20.2657	20.3511	20.3684	20.3674	20.3700	20.3649	20.2436	19.9242	19.6372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9823	0.9450	0.8195	0.5984	0.3506	0.2093	0.2328	0.5190	0.8752	0.9787	0.9937	(94)
Useful gains	940.0770	1049.4948	1150.2454	1144.0856	884.3955	529.1499	299.7975	310.8360	621.4088	898.4657	906.3645	889.8174	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1805.7035	1750.8832	1558.3947	1268.7893	899.8022	529.5676	299.8082	310.8566	626.1305	1052.7729	1452.3493	1783.9839	(97)
Space heating kWh													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98a)
Space heating requirement - total per year (kWh/year)												2693.4449	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2693.4449	
Space heating per m2											(98c) / (4) =	16.8730	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	644.0261	471.3330	303.6631	89.7867	11.4626	0.0000	0.0000	0.0000	0.0000	114.8045	393.1091	665.2599	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	769.4457	563.1219	362.7994	107.2720	13.6948	0.0000	0.0000	0.0000	0.0000	137.1619	469.6644	794.8147	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5492	88.5288	88.4696	88.3425	88.2252	88.2000	88.2000	88.2000	88.2000	88.3681	88.5084	88.5539	(217)
Fuel for water heating, kWh/month													
	312.2595	275.6378	291.6217	253.4757	243.7852	217.2877	212.6934	222.5219	226.4890	254.9936	274.2666	308.4072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3217.9747	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.4394	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5856.6826	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.9747	6.3400	204.0196	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	6.3400	196.1241	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			394.9135	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.9747	0.2100	675.7747	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.4394	0.2100	649.6223	(264)
Space and water heating			1325.3970	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1268.6431	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3217.9747	1.1300	3636.3115	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.4394	1.1300	3495.5865	(278)
Space and water heating			7131.8979	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6467.6207	(286)

Full SAP Calculation Printout

Plot Reference	Plot 3	**Issued on Date**	05/11/2026
Assessment Reference	Lean	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	88 B	**DER**	9.53	**TER**	7.43
Environmental	90 B	**% DER < TER**			-28.26
CO_2 Emissions (t/year)	1.32	**DFEE**	23.20	**TFEE**	27.50
Compliance Check	See BREL	**% DFEE < TFEE**			15.62
% DPER < TPER	-38.10	**DPER**	53.31	**TPER**	38.60

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9977	0.9926	0.9749	0.8954	0.7247	0.5162	0.3738	0.4236	0.6896	0.9486	0.9936	0.9983	(86)
MIT	20.2527	20.3908	20.5826	20.8094	20.9222	20.9500	20.9526	20.9523	20.9361	20.7598	20.4647	20.2323	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9970	0.9906	0.9682	0.8717	0.6801	0.4620	0.3154	0.3607	0.6292	0.9311	0.9915	0.9978	(89)
MIT 2	19.3972	19.5747	19.8178	20.0970	20.2175	20.2484	20.2500	20.2513	20.2358	20.0462	19.6765	19.3768	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9886	0.9644	0.8692	0.6836	0.4680	0.3220	0.3677	0.6351	0.9277	0.9897	0.9971	(94)
Useful gains	852.3121	1002.2973	1116.4336	1164.5278	992.1166	675.7873	443.8579	466.2414	722.7403	892.3101	840.9438	811.4009	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1845.1152	1788.3890	1619.3915	1346.5215	1025.7141	678.2609	444.0294	466.6419	738.4559	1135.9724	1515.7156	1835.7694	(97)
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98a)
Space heating requirement - total per year (kWh/year)												3226.3824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3226.3824	
Space heating per m2											(98c) / (4) =	20.2116	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	882.4917	631.1273	447.0737	156.5537	29.8645	0.0000	0.0000	0.0000	0.0000	216.5887	580.4488	910.5498	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5633	88.5414	88.4953	88.3839	88.2518	88.2000	88.2000	88.2000	88.2000	88.4222	88.5328	88.5675	(217)
Fuel for water heating, kWh/month	312.2101	275.5986	291.5372	253.3570	243.7117	217.2877	212.6934	222.5219	226.4890	254.8377	274.1912	308.3597	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 3854.6982 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.7950 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7377.9712	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3854.6982	0.2100	809.4866	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.7950	0.2100	649.4869	(264)
Space and water heating			1458.9736	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1520.6217	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.5300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3854.6982	1.1300	4355.8090	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.7950	1.1300	3494.8583	(278)
Space and water heating			7850.6673	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8509.1400	(286)
Dwelling Primary energy Rate (DPER)			53.3100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			180.3000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053	(33)
Main dwelling						
Party Wall 1			102.8000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400	19.6403	0.6300	0.7000	0.7700				68.0663	(76)
West				5.7600	19.6403	0.6300	0.7000	0.7700				34.5734	(80)
North				0.2500	15.2954	0.6300	0.7000	1.0000				1.5177	(82)
South				1.0000	47.0123	0.6300	0.7000	1.0000				18.6592	(82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4148.5049	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2544 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3243	0.3180	0.3116	0.2798	0.2735	0.2417	0.2417	0.2353	0.2544	0.2735	0.2862	0.2989	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5526 0.5506 0.5486 0.5392 0.5374 0.5292 0.5292 0.5277 0.5324 0.5374 0.5410 0.5447 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.4734	73.2018	72.9356	71.6853	71.4514	70.3624	70.3624	70.1608	70.7819	71.4514	71.9246	72.4194	(38)
Heat transfer coeff	119.6633	119.3917	119.1255	117.8752	117.6413	116.5523	116.5523	116.3507	116.9718	117.6413	118.1145	118.6093	(39)
Average = Sum(39)m / 12 =												117.8741	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7496	0.7479	0.7463	0.7384	0.7370	0.7301	0.7301	0.7289	0.7328	0.7370	0.7399	0.7430	(40)
HLP (average)												0.7384	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2022	82.3892	82.5733	83.4491	83.6151	84.3963	84.3963	84.5426	84.0936	83.6151	83.2800	82.9327	
alpha	6.4801	6.4926	6.5049	6.5633	6.5743	6.6264	6.6264	6.6362	6.6062	6.5743	6.5520	6.5288	
util living area	0.9986	0.9949	0.9806	0.9087	0.7414	0.5286	0.3827	0.4356	0.7094	0.9593	0.9957	0.9990	(86)
MIT	20.0284	20.2141	20.4750	20.7915	20.9551	20.9957	20.9996	20.9990	20.9746	20.7173	20.3123	19.9992	(87)
Th 2	20.2972	20.2987	20.3001	20.3070	20.3083	20.3143	20.3143	20.3154	20.3120	20.3083	20.3057	20.3030	(88)
util rest of house	0.9981	0.9934	0.9752	0.8869	0.6972	0.4736	0.3233	0.3713	0.6490	0.9448	0.9943	0.9987	(89)
MIT 2	19.3928	19.5789	19.8373	20.1417	20.2790	20.3122	20.3142	20.3151	20.2982	20.0803	19.6829	19.3683	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9919	0.9720	0.8856	0.7041	0.4843	0.3349	0.3840	0.6598	0.9422	0.9929	0.9982	(94)
Useful gains	785.1311	939.0435	1063.2829	1137.0751	985.8862	678.4439	448.3591	470.6299	721.3170	856.0508	783.1887	744.9405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1820.9788	1767.4212	1603.7202	1340.1483	1024.8580	681.4081	448.5720	471.1393	740.5396	1129.9848	1500.8161	1813.7917	(97)
Space heating kWh	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98a)
Space heating requirement - total per year (kWh/year)												3420.3575	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3420.3575	
Space heating per m2											(98c) / (4) =	21.4268	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1095.5920	862.4873	884.2651	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9871	0.9767	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1058.0077	851.3600	863.6548	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	335.6486	450.2306	347.4200	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	83.9121	112.5577	86.8550	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												283.3248	(107)
Energy for space heating												21.4268	(99)
Energy for space cooling												1.7749	(108)
Total												23.2017	(109)
Fabric Energy Efficiency (DFEE)												23.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3586	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3241 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)

Opening Type 3			1.2500	0.9615	1.2019		(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000 (28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000 (29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000 (30)
Total net area of external elements Aum(A, m2)			180.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178		(33)
Main dwelling							
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000 (32)
Internal Wall 1			112.0000			9.0000	1008.0000 (32c)
Internal Ceiling 1			60.6500			9.0000	545.8500 (32e)
Internal Ceiling 2			60.6500			9.0000	545.8500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2721 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484 (42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724 (42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575 (42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836 (42c)
Average daily hot water use (litres/day)												141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7133.8958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			406.9902	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7160	(257)
SAP value		88.3935	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1469.3658	(272)
CO2 emissions per m2			9.2000	(273)
EI value			90.3780	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)											Total = Sum(45)m =	2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	83.7000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6411.0272	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			604.0911	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1317.5634	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			7416.4933	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (9.0%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (11.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 91
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£492	£492	£0
Space heating	£318	£318	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£604	£374	£230
Total cost of uses	£604	£374	£230
Delivered energy	40 kWh/m²	35 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.2 tonnes	0.1 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	1 kg/m²
Primary energy	46 kWh/m²	38 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.2721	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =		46.1899	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2										(98c) / (4) =		18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6280.7162	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			266.3009	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4685 (257)
SAP value		92.4057
SAP rating (Section 12)		92 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1355.2740	(272)
CO2 emissions per m2			8.4900	(273)
EI value			91.1251	
EI rating			91	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)			Volume (m3)	
Main dwelling							
Ground floor	60.6500	(1b)	x 2.4000	(2b)	=	145.5600	(1b) - (3b)
First floor	60.6500	(1c)	x 2.6000	(2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300	(1d)	x 2.6000	(2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		=	402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	46.1899	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484	(42)
Hot water usage for mixer showers	73.6546 72.5477 70.9347 67.8487 65.5712 63.0314 61.5878 63.1885 64.9432 67.6702 70.8226	73.3724	(42a)
Hot water usage for baths	33.4706 32.9735 32.2735 30.9829 30.0164 28.9448 28.3660 29.0611 29.8179 30.9646 32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836 45.4678 43.7521 42.0363 40.3205 38.6048 38.6048 40.3205 42.0363 43.7521 45.4678	47.1836	(42c)
Average daily hot water use (litres/day)		141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction											fLA = Living area / (4) =	0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5525.8177	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			373.9366	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1199.1615	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6093.7434	(286)

Full SAP Calculation Printout

Plot Reference	Plot 3	**Issued on Date**	05/11/2026
Assessment Reference	Green	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	98 A	**DER**	6.73	**TER**	7.43
Environmental	93 A	**% DER < TER**			9.42
CO_2 Emissions (t/year)	0.85	**DFEE**	23.20	**TFEE**	27.50
Compliance Check	See BREL	**% DFEE < TFEE**			15.62
% DPER < TPER	9.25	**DPER**	35.03	**TPER**	38.60

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35411.7000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							221.8361	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9977	0.9926	0.9749	0.8954	0.7247	0.5162	0.3738	0.4236	0.6896	0.9486	0.9936	0.9983	(86)
MIT	20.2527	20.3908	20.5826	20.8094	20.9222	20.9500	20.9526	20.9523	20.9361	20.7598	20.4647	20.2323	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9970	0.9906	0.9682	0.8717	0.6801	0.4620	0.3154	0.3607	0.6292	0.9311	0.9915	0.9978	(89)
MIT 2	19.3972	19.5747	19.8178	20.0970	20.2175	20.2484	20.2500	20.2513	20.2358	20.0462	19.6765	19.3768	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5651	19.7349	19.9679	20.2368	20.3558	20.3861	20.3879	20.3889	20.3733	20.1863	19.8312	19.5447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9886	0.9644	0.8692	0.6836	0.4680	0.3220	0.3677	0.6351	0.9277	0.9897	0.9971	(94)
Useful gains	852.3121	1002.2973	1116.4336	1164.5278	992.1166	675.7873	443.8579	466.2414	722.7403	892.3101	840.9438	811.4009	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1845.1152	1788.3890	1619.3915	1346.5215	1025.7141	678.2609	444.0294	466.6419	738.4559	1135.9724	1515.7156	1835.7694	(97)
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98a)
Space heating requirement - total per year (kWh/year)												3226.3824	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3226.3824	
Space heating per m2											(98c) / (4) =	20.2116	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	738.6456	528.2536	374.2007	131.0355	24.9966	0.0000	0.0000	0.0000	0.0000	181.2848	485.8357	762.1302	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	882.4917	631.1273	447.0737	156.5537	29.8645	0.0000	0.0000	0.0000	0.0000	216.5887	580.4488	910.5498	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5633	88.5414	88.4953	88.3839	88.2518	88.2000	88.2000	88.2000	88.2000	88.4222	88.5328	88.5675	(217)
Fuel for water heating, kWh/month	312.2101	275.5986	291.5372	253.3570	243.7117	217.2877	212.6934	222.5219	226.4890	254.8377	274.1912	308.3597	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 3854.6982 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.7950 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -3454.4788 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3923.4924	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3854.6982	0.2100	809.4866	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.7950	0.2100	649.4869	(264)
Space and water heating			1458.9736	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1074.6725	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.7300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3854.6982	1.1300	4355.8090	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.7950	1.1300	3494.8583	(278)
Space and water heating			7850.6673	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	1.4985	-1911.9450	
PV Unit electricity exported	-2178.5650	0.4614	-1005.2333	
Total			-2917.1783	(283)
Total Primary energy kWh/year			5591.9617	(286)
Dwelling Primary energy Rate (DPER)			35.0300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 53.7639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												138.1375	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area	0.9981	0.9948	0.9846	0.9371	0.8101	0.6036	0.4415	0.4956	0.7687	0.9667	0.9952	0.9986	(86)
MIT	19.9448	20.1144	20.3625	20.6916	20.9084	20.9876	20.9985	20.9970	20.9503	20.6486	20.2418	19.9222	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house	0.9976	0.9934	0.9801	0.9196	0.7668	0.5391	0.3686	0.4183	0.7062	0.9539	0.9936	0.9982	(89)
MIT 2	18.9873	19.2056	19.5219	19.9342	20.1775	20.2575	20.2645	20.2654	20.2261	19.8904	19.3763	18.9644	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1753	19.3839	19.6869	20.0829	20.3210	20.4008	20.4086	20.4090	20.3683	20.0392	19.5462	19.1524	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9911	0.9758	0.9149	0.7707	0.5513	0.3829	0.4334	0.7158	0.9492	0.9915	0.9973	(94)
Useful gains	830.7994	959.8986	1055.8821	1124.6026	1014.0027	719.5403	477.3420	500.5708	751.9318	862.2173	814.9885	794.1436	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.3508	1874.2112	1701.5983	1423.9586	1094.9951	728.1870	478.0992	502.1508	790.4496	1198.9243	1588.8765	1918.8981	(97)
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98a)
Space heating requirement - total per year (kWh/year)												3833.2185	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3833.2185	
Space heating per m2											(98c) / (4) =	24.0131	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	818.0662	614.4181	480.4128	215.5363	60.2583	0.0000	0.0000	0.0000	0.0000	250.5100	557.1994	836.8174	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	885.3531	664.9546	519.9273	233.2644	65.2146	0.0000	0.0000	0.0000	0.0000	271.1147	603.0297	905.6465	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.6918	86.4139	85.8390	84.4237	82.1035	80.3000	80.3000	80.3000	80.3000	84.7200	86.2269	86.7459	(217)
Fuel for water heating, kWh/month	294.4775	261.1492	279.3667	250.3291	249.8294	230.5536	228.0046	236.9707	239.4327	252.5854	263.2483	291.1913	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4148.5049	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3077.1386	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4626.4438	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4148.5049	0.2100	871.1860	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3077.1386	0.2100	646.1991	(264)
Space and water heating			1517.3851	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1186.5793	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4148.5049	1.1300	4687.8106	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3077.1386	1.1300	3477.1666	(278)
Space and water heating			8164.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6162.3075	(286)
Target Primary Energy Rate (TPER)			38.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

													Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =													40.0000 / (5) =	0.0993 (8)
Pressure test														Yes
Pressure Test Method														Blower Door
Measured/design AP50														4.0000 (17)
Infiltration rate														0.2993 (18)
Number of sides sheltered														2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.2544 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3243	0.3180	0.3116	0.2798	0.2735	0.2417	0.2417	0.2353	0.2544	0.2735	0.2862	0.2989	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.4734	73.2018	72.9356	71.6853	71.4514	70.3624	70.3624	70.1608	70.7819	71.4514	71.9246	72.4194	(38)
Heat transfer coeff													
	119.6633	119.3917	119.1255	117.8752	117.6413	116.5523	116.5523	116.3507	116.9718	117.6413	118.1145	118.6093	(39)
Average = Sum(39)m / 12 =												117.8741	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7496	0.7479	0.7463	0.7384	0.7370	0.7301	0.7301	0.7289	0.7328	0.7370	0.7399	0.7430	(40)
HLP (average)												0.7384	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day)	70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	

Distribution loss (46)m = 0.15 x (45)m

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													

	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2022	82.3892	82.5733	83.4491	83.6151	84.3963	84.3963	84.5426	84.0936	83.6151	83.2800	82.9327	
alpha	6.4801	6.4926	6.5049	6.5633	6.5743	6.6264	6.6264	6.6362	6.6062	6.5743	6.5520	6.5288	
util living area													
	0.9986	0.9949	0.9806	0.9087	0.7414	0.5286	0.3827	0.4356	0.7094	0.9593	0.9957	0.9990	(86)
MIT	20.0284	20.2141	20.4750	20.7915	20.9551	20.9957	20.9996	20.9990	20.9746	20.7173	20.3123	19.9992	(87)
Th 2	20.2972	20.2987	20.3001	20.3070	20.3083	20.3143	20.3143	20.3154	20.3120	20.3083	20.3057	20.3030	(88)
util rest of house													
	0.9981	0.9934	0.9752	0.8869	0.6972	0.4736	0.3233	0.3713	0.6490	0.9448	0.9943	0.9987	(89)
MIT 2	19.3928	19.5789	19.8373	20.1417	20.2790	20.3122	20.3142	20.3151	20.2982	20.0803	19.6829	19.3683	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5175	19.7036	19.9624	20.2692	20.4117	20.4464	20.4487	20.4493	20.4309	20.2053	19.8064	19.4922	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9919	0.9720	0.8856	0.7041	0.4843	0.3349	0.3840	0.6598	0.9422	0.9929	0.9982	(94)
Useful gains	785.1311	939.0435	1063.2829	1137.0751	985.8862	678.4439	448.3591	470.6299	721.3170	856.0508	783.1887	744.9405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1820.9788	1767.4212	1603.7202	1340.1483	1024.8580	681.4081	448.5720	471.1393	740.5396	1129.9848	1500.8161	1813.7917	(97)
Space heating kWh													
	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98a)
Space heating requirement - total per year (kWh/year)												3420.3575	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	770.6707	556.6698	402.0853	146.2126	28.9950	0.0000	0.0000	0.0000	0.0000	203.8069	516.6918	795.2253	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3420.3575	
Space heating per m2											(98c) / (4) =	21.4268	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1095.5920	862.4873	884.2651	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9657	0.9871	0.9767	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1058.0077	851.3600	863.6548	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	335.6486	450.2306	347.4200	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.9121	112.5577	86.8550	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	283.3248	(107)
Energy for space heating	21.4268	(99)
Energy for space cooling	1.7749	(108)
Total	23.2017	(109)
Fabric Energy Efficiency (DFEE)	23.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2969	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3785	0.3711	0.3637	0.3266	0.3192	0.2820	0.2820	0.2746	0.2969	0.3192	0.3340	0.3488	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5716	0.5689	0.5661	0.5533	0.5509	0.5398	0.5398	0.5377	0.5441	0.5509	0.5558	0.5608	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1800	7.2018			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4053			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	221.8361	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3586	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	53.7639	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.0054	75.6355	75.2729	73.5700	73.2514	71.7681	71.7681	71.4935	72.3395	73.2514	73.8959	74.5698	(38)
Heat transfer coeff	129.7693	129.3994	129.0368	127.3338	127.0152	125.5320	125.5320	125.2573	126.1033	127.0152	127.6598	128.3336	(39)
Average = Sum(39)m / 12 =												127.3323	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8129	0.8106	0.8083	0.7977	0.7957	0.7864	0.7864	0.7847	0.7900	0.7957	0.7997	0.8039	(40)
HLP (average)												0.7977	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses													
	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												70.2304	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
tau	75.8006	76.0172	76.2308	77.2503	77.4441	78.3592	78.3592	78.5310	78.0042	77.4441	77.0531	76.6485	
alpha	6.0534	6.0678	6.0821	6.1500	6.1629	6.2239	6.2239	6.2354	6.2003	6.1629	6.1369	6.1099	
util living area													
	0.9988	0.9965	0.9888	0.9487	0.8310	0.6241	0.4574	0.5156	0.7940	0.9753	0.9969	0.9991	(86)
MIT	19.8884	20.0600	20.3133	20.6579	20.8938	20.9852	20.9981	20.9962	20.9404	20.6104	20.1918	19.8664	(87)
Th 2	20.2421	20.2441	20.2461	20.2553	20.2571	20.2651	20.2651	20.2666	20.2620	20.2571	20.2536	20.2499	(88)
util rest of house													
	0.9985	0.9955	0.9854	0.9336	0.7895	0.5583	0.3821	0.4355	0.7330	0.9653	0.9958	0.9989	(89)
MIT 2	19.2081	19.3808	19.6337	19.9744	20.1842	20.2580	20.2646	20.2654	20.2278	19.9356	19.5203	19.1925	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3416	19.5141	19.7671	20.1086	20.3234	20.4007	20.4085	20.4088	20.3677	20.0680	19.6521	19.3247	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9942	0.9827	0.9302	0.7935	0.5707	0.3969	0.4512	0.7424	0.9621	0.9947	0.9985	(94)
Useful gains	760.1773	892.7025	996.9862	1087.6765	1000.0465	717.7510	477.1665	500.1589	743.4293	818.6902	753.2617	724.2280	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1951.9350	1891.0562	1711.9420	1427.2310	1095.3088	728.1730	478.0937	502.1358	790.3762	1202.5835	1602.3976	1941.0121	(97)
Space heating kWh													
	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98a)
Space heating requirement - total per year (kWh/year)												4207.1247	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	886.6677	670.8937	531.9271	244.4792	70.8752	0.0000	0.0000	0.0000	0.0000	285.6166	611.3778	905.2874	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4207.1247	
Space heating per m2											(98c) / (4) =	26.3555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1180.0009	928.9369	951.9558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9147	0.9614	0.9392	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.3482	893.0414	894.0437	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	202.0112	302.8457	224.6822	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	50.5028	75.7114	56.1705	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												182.3848	(107)
Energy for space heating												26.3555	(99)
Energy for space cooling												1.1425	(108)
Total												27.4980	(109)
Fabric Energy Efficiency (TFEE)												27.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616	(217)
Fuel for water heating, kWh/month	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3679.4170	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			74.8103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1316	(257)
SAP value		97.8666	
SAP rating (Section 12)		98	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1023.4167	(272)
CO2 emissions per m2			6.4100	(273)
EI value			93.2983	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 402.9080 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 221.8361 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)											Total = Sum(45)m =	2355.8227	

Distribution loss (46)m = 0.15 x (45)m

36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)

Water storage loss (or HIU loss):
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153 (61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)

Total per year (kWh/year) = Sum(64)m = 2733.9853 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354 (71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)

Space heating requirement - total per year (kWh/year) 2416.2189

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976 (98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2416.2189

Space heating per m2 (98c) / (4) = 15.1364 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month													
	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2762.7079	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			126.6917	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	

Total		-469.7486 (269)
Total CO2, kg/year		847.8148 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4373.2980	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 98
Current environmental impact rating: A 93

N Solar water heating	SAP increase too small	
U Solar photovoltaic panels	Already installed	
V2 Wind turbine	Not applicable	

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 31	-152 kg (18.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 98
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£492	£492	£0
Space heating	£318	£318	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£477	-£477	£0
Total cost of fuels	£127	£127	£0
Total cost of uses	£127	£127	£0
Delivered energy	17 kWh/m²	17 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	27 kWh/m²	27 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b)	- (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c)	- (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)

Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3512	0.3444	0.3375	0.3030	0.2961	0.2617	0.2617	0.2548	0.2755	0.2961	0.3099	0.3237	(22b)
Effective ac	0.5617	0.5593	0.5569	0.5459	0.5439	0.5342	0.5342	0.5325	0.5379	0.5439	0.5480	0.5524	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.6815	74.3630	74.0508	72.5845	72.3102	71.0331	71.0331	70.7966	71.5250	72.3102	72.8652	73.4454	(38)
Heat transfer coeff	120.8713	120.5529	120.2407	118.7744	118.5001	117.2230	117.2230	116.9865	117.7149	118.5001	119.0551	119.6353	(39)
Average = Sum(39)m / 12 =												118.7731	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7572	0.7552	0.7532	0.7441	0.7423	0.7343	0.7343	0.7329	0.7374	0.7423	0.7458	0.7495	(40)
HLP (average)												0.7441	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
											Total per year (kWh/year) = Sum(64)m =	2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	81.3806	81.5956	81.8074	82.8174	83.0091	83.9134	83.9134	84.0830	83.5627	83.0091	82.6221	82.2214	
alpha	6.4254	6.4397	6.4538	6.5212	6.5339	6.5942	6.5942	6.6055	6.5708	6.5339	6.5081	6.4814	
util living area													
	0.9963	0.9905	0.9685	0.8861	0.7166	0.5160	0.3735	0.4220	0.6840	0.9401	0.9914	0.9973	(86)
MIT	20.2954	20.4186	20.6110	20.8194	20.9241	20.9500	20.9526	20.9523	20.9369	20.7746	20.4915	20.2719	(87)
Th 2	20.2906	20.2923	20.2940	20.3021	20.3036	20.3106	20.3106	20.3119	20.3079	20.3036	20.3005	20.2974	(88)
util rest of house													
	0.9953	0.9880	0.9603	0.8612	0.6720	0.4618	0.3152	0.3593	0.6238	0.9206	0.9887	0.9966	(89)
MIT 2	19.4518	19.6099	19.8527	20.1079	20.2191	20.2484	20.2500	20.2513	20.2363	20.0631	19.7104	19.4274	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6174	19.7686	20.0015	20.2475	20.3575	20.3861	20.3879	20.3889	20.3738	20.2028	19.8637	19.5932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9857	0.9563	0.8590	0.6755	0.4678	0.3217	0.3664	0.6297	0.9173	0.9865	0.9956	(94)
Useful gains	922.7800	1047.5208	1161.1595	1179.0151	994.4695	675.7946	443.8588	466.2514	723.5402	914.2956	884.3798	876.7109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1851.4305	1792.4569	1623.4328	1347.7956	1025.9137	678.2615	444.0295	466.6428	738.5240	1137.9297	1519.5798	1841.5646	(97)
Space heating kWh													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98a)
Space heating requirement - total per year (kWh/year)												3021.9398	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3021.9398	
Space heating per m2											(98c) / (4) =	18.9309	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	690.9159	500.5970	343.9314	121.5220	23.3945	0.0000	0.0000	0.0000	0.0000	166.3838	457.3440	717.8512	(98)
Space heating efficiency (main heating system 1)													

	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)												
	825.4671	598.0849	410.9096	145.1876	27.9504	0.0000	0.0000	0.0000	0.0000	198.7859	546.4086	857.6478 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
Efficiency of water heater												88.2000 (216)
(217)m	88.5565	88.5355	88.4850	88.3752	88.2488	88.2000	88.2000	88.2000	88.2000	88.4117	88.5260	88.5616 (217)
Fuel for water heating, kWh/month												
	312.2338	275.6169	291.5710	253.3819	243.7199	217.2877	212.6934	222.5219	226.4890	254.8680	274.2122	308.3803 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3610.4418	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.9760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3679.4170	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.4418	3.6400	131.4201	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.9760	3.6400	112.5843	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			74.8103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.1316	(257)
SAP value	97.8666	
SAP rating (Section 12)	98	(258)
SAP band	A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.4418	0.2100	758.1928	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.9760	0.2100	649.5250	(264)
Space and water heating			1407.7177	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)

Total CO2, kg/year	1023.4167 (272)
CO2 emissions per m2	6.4100 (273)
EI value	93.2983
EI rating	93 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2755	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.2893	0.2755	0.2755	0.2548	0.2548	0.2273	0.2342	0.2204	0.2273	0.2410	0.2410	0.2617	(22b)
Effective ac	0.5418	0.5379	0.5379	0.5325	0.5325	0.5258	0.5274	0.5243	0.5258	0.5291	0.5291	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	0.9615	1.2019			(27a)
Heatloss Floor 1			60.6500	0.1200	7.2780	110.0000	6671.5000	(28a)
External Wall 1	59.0000	18.9900	40.0100	0.1600	6.4016	190.0000	7601.9000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			180.3000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.9178			(33)
Main dwelling								
Party Wall 1			102.8000	0.0000	0.0000	180.0000	18504.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35411.7000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		221.8361 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	46.1899 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.0422	71.5250	71.5250	70.7966	70.7966	69.9137	70.1250	69.7088	69.9137	70.3426	70.3426	71.0331	(38)
Heat transfer coeff	118.2321	117.7149	117.7149	116.9865	116.9865	116.1036	116.3149	115.8987	116.1036	116.5325	116.5325	117.2230	(39)
Average = Sum(39)m / 12 =												116.8620	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7407	0.7374	0.7374	0.7329	0.7329	0.7273	0.7287	0.7260	0.7273	0.7300	0.7300	0.7343	(40)
HLP (average)												0.7321	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.1973	83.5627	83.5627	84.0830	84.0830	84.7225	84.5686	84.8723	84.7225	84.4107	84.4107	83.9134	
alpha	6.5465	6.5708	6.5708	6.6055	6.6055	6.6482	6.6379	6.6582	6.6482	6.6274	6.6274	6.5942	
util living area													
	0.9944	0.9870	0.9547	0.8350	0.6215	0.3842	0.2518	0.2777	0.5570	0.8953	0.9847	0.9959	(86)
MIT	20.3881	20.4958	20.6883	20.8729	20.9425	20.9529	20.9532	20.9533	20.9493	20.8467	20.5892	20.3667	(87)
Th 2	20.3051	20.3079	20.3079	20.3119	20.3119	20.3168	20.3156	20.3179	20.3168	20.3144	20.3144	20.3106	(88)
util rest of house													
	0.9928	0.9835	0.9431	0.8025	0.5721	0.3319	0.1962	0.2185	0.4938	0.8641	0.9798	0.9947	(89)
MIT 2	19.5823	19.7210	19.9599	20.1759	20.2439	20.2566	20.2555	20.2580	20.2546	20.1548	19.8455	19.5597	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.7404	19.8731	20.1029	20.3127	20.3810	20.3933	20.3924	20.3944	20.3909	20.2906	19.9915	19.7181	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9808	0.9391	0.8025	0.5771	0.3378	0.2024	0.2252	0.5007	0.8629	0.9769	0.9933	(94)
Useful gains	939.5762	1047.8738	1143.0168	1120.4203	852.9940	509.8240	289.9020	300.6816	599.5495	885.8439	904.6816	889.5180	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1730.9686	1680.1511	1495.3158	1218.1466	863.4778	510.0730	289.9077	300.6930	602.6850	1012.7332	1397.3983	1713.5739	(97)
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98a)
Space heating requirement - total per year (kWh/year)												2416.2189	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2416.2189	
Space heating per m2											(98c) / (4) =	15.1364	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.7960	424.8904	262.1104	70.3629	7.8000	0.0000	0.0000	0.0000	0.0000	94.4056	354.7560	613.0976	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	703.4599	507.6348	313.1546	84.0656	9.3190	0.0000	0.0000	0.0000	0.0000	112.7905	423.8423	732.4941	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5396	88.5169	88.4513	88.3190	88.2174	88.2000	88.2000	88.2000	88.2000	88.3470	88.4962	88.5453	(217)
Fuel for water heating, kWh/month	312.2934	275.6748	291.6822	253.5431	243.8067	217.2877	212.6934	222.5219	226.4890	255.0545	274.3046	308.4371	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2886.7609	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.7883	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2762.7079	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.7609	6.3400	183.0206	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	6.3400	196.1462	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)

Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			126.6917	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.7609	0.2100	606.2198	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.7883	0.2100	649.6956	(264)
Space and water heating			1255.9153	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	
Total			-469.7486	(269)
Total CO2, kg/year			847.8148	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2886.7609	1.1300	3262.0398	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.7883	1.1300	3495.9808	(278)
Space and water heating			6758.0206	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4373.2980	(286)

Full SAP Calculation Printout

Plot Reference	Plot 4	Issued on Date	05/11/2026
Assessment Reference	Baseline	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	87 B	DER	11.09	TER	8.30
Environmental	89 B	% DER < TER			-33.61
CO_2 Emissions (t/year)	1.52	DFEE	29.04	TFEE	31.36
Compliance Check	See BREL	% DFEE < TFEE			7.38
% DPER < TPER	-42.73	DPER	61.73	TPER	43.25

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9981	0.9944	0.9823	0.9268	0.7880	0.5800	0.4237	0.4789	0.7549	0.9643	0.9951	0.9986	(86)
MIT	20.1000	20.2415	20.4479	20.7159	20.8817	20.9396	20.9472	20.9462	20.9102	20.6701	20.3414	20.0855	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9975	0.9928	0.9770	0.9067	0.7413	0.5139	0.3497	0.3998	0.6889	0.9503	0.9934	0.9981	(89)
MIT 2	19.1205	19.3034	19.5671	19.9054	20.0897	20.1520	20.1569	20.1585	20.1261	19.8586	19.4419	19.1104	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9909	0.9733	0.9024	0.7433	0.5211	0.3582	0.4089	0.6944	0.9461	0.9917	0.9975	(94)
Useful gains	852.7463	1004.6038	1126.7026	1208.9671	1078.8681	752.4601	493.7884	518.3634	790.2552	910.0077	842.6333	811.6679	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2086.2006	2019.7748	1826.6700	1514.4961	1155.4702	760.1502	494.4561	519.7894	827.9979	1273.4817	1703.7061	2069.1085	(97)
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98a)
Space heating requirement - total per year (kWh/year)												4223.5663	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4223.5663	
Space heating per m2											(98c) / (4) =	26.4585	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1096.4038	815.0477	622.1932	262.8206	68.0908	0.0000	0.0000	0.0000	0.0000	323.0879	740.7077	1117.7249	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5837	88.5677	88.5337	88.4471	88.3043	88.2000	88.2000	88.2000	88.2000	88.4720	88.5587	88.5865	(217)
Fuel for water heating, kWh/month	312.1379	275.5167	291.4106	253.1761	243.5668	217.2877	212.6934	222.5219	226.4890	254.6942	274.1108	308.2936	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 5046.0768 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3091.8986 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8568.4534	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5046.0768	0.2100	1059.6761	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3091.8986	0.2100	649.2987	(264)
Space and water heating			1708.9748	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1770.6229	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5046.0768	1.1300	5702.0668	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3091.8986	1.1300	3493.8454	(278)
Space and water heating			9195.9122	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9854.3848	(286)
Dwelling Primary energy Rate (DPER)			61.7300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			11.3400	19.6403	0.6300	0.7000	0.7700	68.0663 (76)				
West			5.7600	19.6403	0.6300	0.7000	0.7700	34.5734 (80)				
North			0.2500	15.2954	0.6300	0.7000	1.0000	1.5177 (82)				
South			1.0000	47.0123	0.6300	0.7000	1.0000	18.6592 (82)				
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965 (64)
Efficiency of water heater												80.3000 (216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279 (217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4813.0912 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5848 0.5815 0.5783 0.5632 0.5603 0.5471 0.5471 0.5447 0.5522 0.5603 0.5661 0.5721 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	137.3014	136.8634	136.4340	134.4173	134.0399	132.2834	132.2834	131.9581	132.9600	134.0399	134.8033	135.6013	(39)
Average = Sum(39)m / 12 =												134.4155	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8601	0.8574	0.8547	0.8421	0.8397	0.8287	0.8287	0.8267	0.8329	0.8397	0.8445	0.8495	(40)
HLP (average)												0.8420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.9320	73.1654	73.3957	74.4969	74.7066	75.6986	75.6986	75.8852	75.3134	74.7066	74.2836	73.8464	
alpha	5.8621	5.8777	5.8930	5.9665	5.9804	6.0466	6.0466	6.0590	6.0209	5.9804	5.9522	5.9231	
util living area													
	0.9988	0.9960	0.9862	0.9364	0.8025	0.5927	0.4332	0.4916	0.7729	0.9717	0.9966	0.9991	(86)
MIT	19.8379	20.0273	20.3055	20.6716	20.9049	20.9873	20.9983	20.9966	20.9437	20.6041	20.1584	19.8155	(87)
Th 2	20.2015	20.2039	20.2062	20.2170	20.2191	20.2285	20.2285	20.2303	20.2249	20.2191	20.2150	20.2107	(88)
util rest of house													
	0.9984	0.9948	0.9819	0.9182	0.7570	0.5260	0.3581	0.4112	0.7080	0.9601	0.9954	0.9988	(89)
MIT 2	19.1238	19.3144	19.5917	19.9520	20.1556	20.2225	20.2281	20.2292	20.1936	19.8961	19.4546	19.1087	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9933	0.9787	0.9149	0.7622	0.5387	0.3728	0.4270	0.7184	0.9567	0.9942	0.9984	(94)
Useful gains	785.3285	940.4418	1070.6395	1174.6195	1067.2523	754.6366	499.1178	523.4005	785.3459	869.2465	784.1469	745.0492	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.5719	1991.9565	1805.2689	1504.5682	1153.0991	763.6230	499.9302	525.1711	829.7765	1264.6724	1684.0577	2040.4538	(97)
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98a)
Space heating requirement - total per year (kWh/year)												4404.8460	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4404.8460	
Space heating per m2											(98c) / (4) =	27.5941	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1243.4642	978.8974	1002.8819	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9294	0.9684	0.9486	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1155.6593	947.9766	951.3502	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	265.3394	378.3478	282.1746	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	66.3349	94.5870	70.5437	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												231.4655	(107)
Energy for space heating												27.5941	(99)
Energy for space cooling												1.4500	(108)
Total												29.0441	(109)
Fabric Energy Efficiency (DFEE)												29.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)

Opening Type 3			1.2500	1.1450	1.4313		(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000 (28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000 (29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000 (30)
Total net area of external elements Aum(A, m2)			232.3500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688		(33)
Main dwelling							
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000 (32)
Internal Wall 1			112.0000			9.0000	1008.0000 (32c)
Internal Ceiling 1			60.6500			9.0000	545.8500 (32e)
Internal Ceiling 2			60.6500			9.0000	545.8500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2											(98c) / (4) =	25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8314.7544	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			449.9735	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7916	(257)
SAP value		87.1677	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1717.3461	(272)
CO2 emissions per m2			10.7600	(273)
EI value			88.7541	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7376.6042	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			665.3087	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1520.3346	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8507.5952	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (7.8%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	B 91	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£553	£553	£0
Space heating	£380	£380	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£665	£435	£230
Total cost of uses	£666	£436	£230
Delivered energy	46 kWh/m²	41 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.4 tonnes	0.1 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	1 kg/m²
Primary energy	53 kWh/m²	45 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3741 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2										(98c) / (4) =		25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7461.5747	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			309.2842	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5441 (257)
SAP value		91.1799
SAP rating (Section 12)		91 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1603.2543	(272)
CO2 emissions per m2			10.0400	(273)
EI value			89.5012	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)											141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area													
	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house													
	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6491.3947	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			435.1542	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1401.9326	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			7184.8454	(286)

Full SAP Calculation Printout

Plot Reference	Plot 4	Issued on Date	05/11/2026
Assessment Reference	Lean	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	88 B	DER	10.34	TER	8.30
Environmental	90 B	% DER < TER			-24.58
CO_2 Emissions (t/year)	1.43	DFEE	26.25	TFEE	31.36
Compliance Check	See BREL	% DFEE < TFEE			16.30
% DPER < TPER	-33.43	DPER	57.71	TPER	43.25

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)

Average = Sum(39)m / 12 = 127.7343

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 4477.1386 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 88.2000
Water heating fuel used 3092.2959 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7999.9125	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1651.2293	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9211.9336	(286)
Dwelling Primary energy Rate (DPER)			57.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400	19.6403	0.6300	0.7000	0.7700				68.0663	(76)
West				5.7600	19.6403	0.6300	0.7000	0.7700				34.5734	(80)
North				0.2500	15.2954	0.6300	0.7000	1.0000				1.5177	(82)
South				1.0000	47.0123	0.6300	0.7000	1.0000				18.6592	(82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4813.0912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2768 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5623 0.5599 0.5575 0.5464 0.5443 0.5346 0.5346 0.5328 0.5383 0.5443 0.5485 0.5529 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												253.5180	(107)
Energy for space heating												24.6606	(99)
Energy for space cooling												1.5882	(108)
Total												26.2487	(109)
Fabric Energy Efficiency (DFEE)												26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)

Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7749.5719	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			429.4008	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7554	(257)
SAP value		87.7544	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1598.6578	(272)
CO2 emissions per m2			10.0100	(273)
EI value			89.5313	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6929.2104	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			636.9439	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1426.3819	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8002.0403	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (8.3%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£637	£407	£230
Total cost of uses	£637	£407	£230
Delivered energy	43 kWh/m²	38 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.3 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	50 kWh/m²	42 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2										(98c) / (4) =		22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6896.3923	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			288.7115	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5079	(257)
SAP value		91.7666	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1484.5660	(272)
CO2 emissions per m2			9.3000	(273)
EI value			90.2785	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	54.0265	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484	(42)
Hot water usage for mixer showers	73.6546 72.5477 70.9347 67.8487 65.5712 63.0314 61.5878 63.1885 64.9432 67.6702 70.8226	73.3724	(42a)
Hot water usage for baths	33.4706 32.9735 32.2735 30.9829 30.0164 28.9448 28.3660 29.0611 29.8179 30.9646 32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836 45.4678 43.7521 42.0363 40.3205 38.6048 38.6048 40.3205 42.0363 43.7521 45.4678	47.1836	(42c)
Average daily hot water use (litres/day)		141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6044.0010	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			406.7894	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1307.9799	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6679.2905	(286)

Full SAP Calculation Printout

Plot Reference	Plot 4	Issued on Date	05/11/2026
Assessment Reference	Green	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	97 A	DER	7.55	TER	8.30
Environmental	92 A	% DER < TER			9.04
CO_2 Emissions (t/year)	0.96	DFEE	26.25	TFEE	31.36
Compliance Check	See BREL	% DFEE < TFEE			16.30
% DPER < TPER	8.82	DPER	39.43	TPER	43.25

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4477.1386 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.2959 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -3454.4788 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4545.4337	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1205.2802	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	1.4985	-1911.9450	
PV Unit electricity exported	-2178.5650	0.4614	-1005.2333	
Total			-2917.1783	(283)
Total Primary energy kWh/year			6294.7553	(286)
Dwelling Primary energy Rate (DPER)			39.4300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
										Total per year (kWh/year) = Sum(64)m =		2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4813.0912	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2768	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff													
	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day)	70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
								Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)											991	(64)
Electric shower(s)												

	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area													
	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house													
	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	253.5180	(107)
Energy for space heating	24.6606	(99)
Energy for space cooling	1.5882	(108)
Total	26.2487	(109)
Fabric Energy Efficiency (DFEE)	26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3586	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	63.1329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)

Average = Sum(39)m / 12 =	138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses													
	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												70.2304	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

---
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate
---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)
Total internal gains												
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month													
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4295.0931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710	(257)
SAP value		97.2275	
SAP rating (Section 12)		97	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1152.7087	(272)
CO2 emissions per m2			7.2200	(273)
EI value			92.4516	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 402.9080 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)											Total = Sum(45)m =	2355.8227	

Distribution loss (46)m = 0.15 x (45)m

36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)

Water storage loss (or HIU loss):
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153 (61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)

Total per year (kWh/year) = Sum(64)m = 2733.9853 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354 (71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	

Total	-469.7486 (269)
Total CO2, kg/year	956.6333 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 97
Current environmental impact rating: A 92

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Already installed
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 31	-152 kg (15.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£477	-£477	£0
Total cost of fuels	£160	£160	£0
Total cost of uses	£160	£160	£0
Delivered energy	21 kWh/m²	21 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	31 kWh/m²	31 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b)	- (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c)	- (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)

Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)	141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
											Total per year (kWh/year) = Sum(64)m =	2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction											fLA = Living area / (4) =	0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													

	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)												
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
Efficiency of water heater												88.2000 (216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734 (217)
Fuel for water heating, kWh/month												
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4226.6405 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	88.2000
Water heating fuel used	3092.4534 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	344.4780 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3454.4788 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4295.0931 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710 (257)
SAP value		97.2275
SAP rating (Section 12)		97 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)

Total CO2, kg/year	1152.7087 (272)
CO2 emissions per m2	7.2200 (273)
EI value	92.4516
EI rating	92 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)

Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	
Total			-469.7486	(269)
Total CO2, kg/year			956.6333	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)

Full SAP Calculation Printout

Plot Reference	Plot 5	Issued on Date	05/11/2026
Assessment Reference	Baseline	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	86 B	DER	12.63	TER	9.49
Environmental	88 B	% DER < TER			-33.09
CO_2 Emissions (t/year)	1.19	DFEE	29.77	TFEE	32.98
Compliance Check	See BREL	% DFEE < TFEE			9.71
% DPER < TPER	-42.22	DPER	70.23	TPER	49.38

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280

E4 Jamb	25.2000	0.0060	0.1512		
E5 Ground floor (normal)	22.2100	0.0930	2.0655		
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000		
E16 Corner (normal)	10.0000	0.0350	0.3500		
E18 Party wall between dwellings	10.0000	0.0000	0.0000		
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.2721	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	56.8629	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	112.1689	111.7855	111.4097	109.6446	109.3143	107.7770	107.7770	107.4923	108.3691	109.3143	109.9824	110.6809	(39)
Average = Sum(39)m / 12 =												109.6430	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0184	1.0149	1.0115	0.9955	0.9925	0.9785	0.9785	0.9760	0.9839	0.9925	0.9986	1.0049	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
12Total per year (kWh/year)												2663	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	600.5726	616.0588	588.2643	566.4002	535.4382	511.8984	490.5875	491.5247	507.8292	529.3584	564.3063	587.1098	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)
Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	818.6138	979.3256	1069.3599	1145.0496	1174.3539	1143.9299	1100.7434	1055.8803	1021.9547	925.9991	823.8498	774.8300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.4478	87.7477	88.0437	89.4611	89.7314	91.0113	91.0113	91.2523	90.5140	89.7314	89.1863	88.6235	
alpha	6.8299	6.8498	6.8696	6.9641	6.9821	7.0674	7.0674	7.0835	7.0343	6.9821	6.9458	6.9082	
util living area													
	0.9980	0.9929	0.9793	0.9289	0.8036	0.5962	0.4302	0.4671	0.7079	0.9450	0.9937	0.9986	(86)
MIT	20.3116	20.4508	20.6086	20.7947	20.9109	20.9512	20.9556	20.9554	20.9410	20.7955	20.5217	20.2928	(87)
Th 2	20.0680	20.0709	20.0737	20.0871	20.0896	20.1013	20.1013	20.1034	20.0968	20.0896	20.0845	20.0792	(88)
util rest of house													
	0.9972	0.9900	0.9710	0.9024	0.7456	0.5159	0.3427	0.3768	0.6261	0.9185	0.9906	0.9980	(89)
MIT 2	19.2658	19.4451	19.6452	19.8783	19.9999	20.0426	20.0447	20.0469	20.0321	19.8860	19.5477	19.2512	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.4359	19.6086	19.8018	20.0273	20.1480	20.1904	20.1928	20.1946	20.1799	20.0339	19.7061	19.4206	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4359	19.6086	19.8018	20.0273	20.1480	20.1904	20.1928	20.1946	20.1799	20.0339	19.7061	19.4206	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9882	0.9679	0.9004	0.7496	0.5240	0.3516	0.3860	0.6340	0.9165	0.9889	0.9975	(94)
Useful gains	815.6963	967.7434	1035.0850	1030.9687	880.3031	599.4248	387.0663	407.5948	647.8751	848.6964	814.7083	772.8691	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1697.7740	1644.2127	1481.9531	1220.0479	923.4908	602.5134	387.2223	407.8918	658.8754	1031.2561	1386.4479	1684.6310	(97)
Space heating kWh													
	656.2658	454.5873	332.4699	136.1371	32.1317	0.0000	0.0000	0.0000	0.0000	135.8244	411.6525	678.3509	(98a)
Space heating requirement - total per year (kWh/year)												2837.4195	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	656.2658	454.5873	332.4699	136.1371	32.1317	0.0000	0.0000	0.0000	0.0000	135.8244	411.6525	678.3509	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2837.4195	
Space heating per m2											(98c) / (4) =	25.7619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	656.2658	454.5873	332.4699	136.1371	32.1317	0.0000	0.0000	0.0000	0.0000	135.8244	411.6525	678.3509	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	784.0690	543.1151	397.2161	162.6488	38.3891	0.0000	0.0000	0.0000	0.0000	162.2753	491.8190	810.4550	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5540	88.5278	88.4841	88.3915	88.2661	88.2000	88.2000	88.2000	88.2000	88.3905	88.5170	88.5587	(217)
Fuel for water heating, kWh/month													
	303.9109	268.3085	283.8665	246.7473	237.4123	211.7894	207.3689	216.9009	220.7130	248.3282	267.0201	300.1750	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3389.9875	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3012.5411	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6729.7821	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3389.9875	0.2100	711.8974	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3012.5411	0.2100	632.6336	(264)
Space and water heating			1344.5310	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1391.2806	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.6300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3389.9875	1.1300	3830.6858	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3012.5411	1.1300	3404.1714	(278)
Space and water heating			7234.8572	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Total Primary energy kWh/year			7735.0009	(286)
Dwelling Primary energy Rate (DPER)			70.2300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)

Main dwelling

Party Wall 1	49.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.5714 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)

Average = Sum(39)m / 12 = 112.3515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 133.9628 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7346	142.6226	138.8328	133.0702	128.3905	123.3595	121.4261	125.1995	129.1791	134.4608	140.3122	145.3566	(44)
Energy conte	230.8079	203.0926	213.3808	182.1664	172.8383	151.6848	146.8543	155.0231	159.2908	182.4620	199.9005	227.5934	(45)

Energy content (annual) Total = Sum(45)m = 2225.0950

Distribution loss (46)m = 0.15 x (45)m

34.6212	30.4639	32.0071	27.3250	25.9257	22.7527	22.0282	23.2535	23.8936	27.3693	29.9851	34.1390	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

281.7668	249.1200	264.3397	231.4815	223.7972	200.9999	197.8132	205.9820	208.6058	233.4210	249.2156	278.5523	(62)
WWHRS -32.6545	-28.8799	-30.2413	-25.0410	-23.3373	-19.9699	-18.7186	-19.9054	-20.6617	-24.3578	-27.5944	-32.0498	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)

Total per year (kWh/year) = Sum(64)m = 2521.6834 (64)

12Total per year (kWh/year) 2522 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

89.4834	79.0351	83.6889	72.8991	70.2084	62.7640	61.5688	64.2849	65.2929	73.4084	78.7957	88.4145	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	120.2733	117.6118	112.4850	101.2487	94.3662	87.1722	82.7538	86.4045	90.6846	98.6671	109.4384	118.8367	(72)
Total internal gains	604.1336	619.7066	592.0590	570.4899	539.7148	516.3680	495.1634	495.9941	512.1762	533.4915	568.1553	590.7064	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains	180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)

Total gains	784.8783	920.8356	990.8620	1050.1598	1069.3423	1040.2889	1000.9505	963.8151	938.3591	862.2858	783.3032	746.3165	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area													
	0.9985	0.9952	0.9870	0.9549	0.8607	0.6639	0.4840	0.5230	0.7702	0.9633	0.9955	0.9989	(86)
MIT	20.0825	20.2502	20.4523	20.7106	20.9015	20.9866	20.9986	20.9977	20.9645	20.7286	20.3621	20.0607	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house													
	0.9979	0.9933	0.9815	0.9355	0.8084	0.5763	0.3839	0.4205	0.6870	0.9435	0.9933	0.9985	(89)
MIT 2	18.9834	19.1993	19.4570	19.7833	19.9930	20.0744	20.0804	20.0823	20.0563	19.8116	19.3535	18.9641	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9913	0.9781	0.9322	0.8129	0.5903	0.4002	0.4372	0.6994	0.9405	0.9914	0.9978	(94)
Useful gains	782.5354	912.8089	969.1325	978.9203	869.2718	614.0405	400.6002	421.4165	656.2723	811.0047	776.5724	744.6875	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1707.3201	1656.7522	1497.1005	1239.7121	945.5546	621.2292	401.0295	422.1929	678.0124	1048.6149	1399.3355	1694.3093	(97)
Space heating kWh													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98a)
Space heating requirement - total per year (kWh/year)												3156.9924	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3156.9924	
Space heating per m2											(98c) / (4) =	28.6635	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	744.6319	541.0496	425.1171	203.2144	61.4225	0.0000	0.0000	0.0000	0.0000	191.3225	485.2700	764.6305	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4392	86.0806	85.4814	84.1788	82.0514	80.3000	80.3000	80.3000	80.3000	84.0241	85.8584	86.5037	(217)
Fuel for water heating, kWh/month													
	288.1938	255.8533	273.8589	245.2404	244.3100	225.4421	223.0319	231.7269	234.0525	248.8132	258.1238	284.9617	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.8955	-69.5185	-98.7462	-109.6378	-117.0170	-108.7321	-107.3249	-101.8736	-92.1243	-78.7820	-54.5359	-43.2297	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-30.7378	-64.3592	-127.3927	-190.6055	-251.3652	-252.3802	-249.4675	-211.5728	-155.5027	-91.8621	-40.9751	-24.3346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3416.6585	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3013.6086	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.2536	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2721.9727	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4035.5479	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3416.6585	0.2100	717.4983	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6086	0.2100	632.8578	(264)
Space and water heating			1350.3561	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	0.1349	-139.0942	
PV Unit electricity exported	-1690.5552	0.1260	-213.0159	
Total			-352.1100	(269)
Total CO2, kg/year			1044.9956	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3416.6585	1.1300	3860.8241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6086	1.1300	3405.3777	(278)
Space and water heating			7266.2018	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	1.4984	-1545.5018	
PV Unit electricity exported	-1690.5552	0.4625	-781.9222	
Total			-2327.4240	(283)
Total Primary energy kWh/year			5438.9214	(286)
Target Primary Energy Rate (TPER)			49.3800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 56.8629 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	112.1689	111.7855	111.4097	109.6446	109.3143	107.7770	107.7770	107.4923	108.3691	109.3143	109.9824	110.6809	(39)

Average = Sum(39)m / 12 = 109.6430

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0184	1.0149	1.0115	0.9955	0.9925	0.9785	0.9785	0.9760	0.9839	0.9925	0.9986	1.0049	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 68.1075 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)
								Total per year (kWh/year) = Sum(64)m =				961.4520	(64)
12Total per year (kWh/year)												961	(64)
Electric shower(s)	57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				650.6798	(64a)
Heat gains from water heating, kWh/month	39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)
Total internal gains													
	533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	751.7348	913.8642	1007.1181	1090.5117	1124.3613	1101.7334	1061.7997	1014.7322	978.1502	873.8457	764.3405	708.9947	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.4478	87.7477	88.0437	89.4611	89.7314	91.0113	91.0113	91.2523	90.5140	89.7314	89.1863	88.6235	
alpha	6.8299	6.8498	6.8696	6.9641	6.9821	7.0674	7.0674	7.0835	7.0343	6.9821	6.9458	6.9082	
util living area													
	0.9988	0.9952	0.9850	0.9425	0.8266	0.6173	0.4458	0.4857	0.7337	0.9580	0.9959	0.9992	(86)
MIT	20.0892	20.2772	20.4935	20.7566	20.9289	20.9921	20.9993	20.9987	20.9754	20.7558	20.3752	20.0640	(87)
Th 2	20.0680	20.0709	20.0737	20.0871	20.0896	20.1013	20.1013	20.1034	20.0968	20.0896	20.0845	20.0792	(88)
util rest of house													
	0.9983	0.9933	0.9787	0.9196	0.7705	0.5350	0.3552	0.3920	0.6513	0.9362	0.9939	0.9989	(89)
MIT 2	19.2417	19.4309	19.6459	19.9048	20.0483	20.0984	20.1011	20.1032	20.0863	19.9109	19.5405	19.2259	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.3795	19.5685	19.7838	20.0433	20.1915	20.2438	20.2472	20.2488	20.2309	20.0483	19.6762	19.3622	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3795	19.5685	19.7838	20.0433	20.1915	20.2438	20.2472	20.2488	20.2309	20.0483	19.6762	19.3622	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9918	0.9761	0.9183	0.7774	0.5484	0.3700	0.4073	0.6642	0.9350	0.9927	0.9985	(94)
Useful gains	750.0900	906.4119	983.0901	1001.3695	874.0345	604.1398	392.8601	413.2884	649.7164	817.0085	758.7330	707.9289	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1691.4527	1639.7305	1479.9390	1221.8044	928.2377	608.2667	393.0808	413.7144	664.4022	1032.8371	1383.1626	1678.1665	(97)
Space heating kWh													
	700.3738	492.7901	369.6556	158.7131	40.3271	0.0000	0.0000	0.0000	0.0000	160.5765	449.5893	721.8568	(98a)
Space heating requirement - total per year (kWh/year)												3093.8823	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	700.3738	492.7901	369.6556	158.7131	40.3271	0.0000	0.0000	0.0000	0.0000	160.5765	449.5893	721.8568	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3093.8823	
Space heating per m2											(98c) / (4) =	28.0905	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1013.1035	797.5496	816.9413	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9422	0.9788	0.9698	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	954.5285	780.6448	792.2394	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1224.1937	1180.4703	1128.3597	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	194.1590	297.4702	250.0735	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	48.5397	74.3675	62.5184	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												185.4257	(107)
Energy for space heating												28.0905	(99)
Energy for space cooling												1.6835	(108)
Total												29.7740	(109)
Fabric Energy Efficiency (DFEE)												29.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							320.6112	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	59.5714	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)
Average = Sum(39)m / 12 =												112.3515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)
Hot water usage for other uses	43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)
Average daily hot water use (litres/day)												68.1075	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)

Total per year (kWh/year) = Sum(64)m = 961.4520 (64)

12Total per year (kWh/year) 961 (64)

Electric shower(s)

57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 650.6798 (64a)

Heat gains from water heating, kWh/month

39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)

Water heating gains (Table 5)

52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)

Total internal gains

533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains 180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)
Total gains 714.4383	851.7264	924.8254	991.5322	1015.0731	993.6227	957.4309	918.1977	890.2077	805.9993	719.9449	676.8846	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area													
	0.9992	0.9970	0.9911	0.9656	0.8835	0.6907	0.5054	0.5480	0.7994	0.9737	0.9973	0.9994	(86)
MIT	20.0261	20.1958	20.4026	20.6738	20.8823	20.9831	20.9982	20.9970	20.9554	20.6914	20.3120	20.0048	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house													
	0.9988	0.9957	0.9871	0.9499	0.8352	0.6015	0.4012	0.4412	0.7178	0.9585	0.9959	0.9992	(89)
MIT 2	19.1619	19.3333	19.5404	19.8129	19.9963	20.0743	20.0804	20.0822	20.0561	19.8351	19.4608	19.1499	(90)

Living area fraction fLA = Living area / (4) = 0.1626 (91)

MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9946	0.9851	0.9476	0.8394	0.6158	0.4183	0.4587	0.7300	0.9564	0.9949	0.9989	(94)
Useful gains	713.2834	847.1295	911.0126	939.5380	852.0584	611.9108	400.4548	421.1315	649.8206	770.8953	716.2638	676.1139	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1723.4428	1668.5850	1504.1475	1241.8272	945.5118	621.1618	401.0211	422.1767	677.8303	1050.1441	1408.5437	1710.9207	(97)
Space heating kWh													
	751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98a)

Space heating requirement - total per year (kWh/year) 3508.1455

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3508.1455

Space heating per m2 (98c) / (4) = 31.8517 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1038.5632	817.5923	837.5257	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8966	0.9562	0.9412	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.1721	781.7868	788.2642	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1097.8306	1058.4808	1015.5271	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	119.9941	205.8604	169.0836	0.0000	0.0000	0.0000	0.0000	(104)

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.9985	51.4651	42.2709	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 123.7345 (107)
Energy for space heating 31.8517 (99)
Energy for space cooling 1.1234 (108)
Total 32.9751 (109)
Fabric Energy Efficiency (TFEE) 33.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280

E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 56.8629 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	112.1689	111.7855	111.4097	109.6446	109.3143	107.7770	107.7770	107.4923	108.3691	109.3143	109.9824	110.6809	(39)
Average = Sum(39)m / 12 =												109.6430	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0184	1.0149	1.0115	0.9955	0.9925	0.9785	0.9785	0.9760	0.9839	0.9925	0.9986	1.0049	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
									Total per year (kWh/year) = Sum(64)m =			2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.4478	87.7477	88.0437	89.4611	89.7314	91.0113	91.0113	91.2523	90.5140	89.7314	89.1863	88.6235	
alpha	6.8299	6.8498	6.8696	6.9641	6.9821	7.0674	7.0674	7.0835	7.0343	6.9821	6.9458	6.9082	
util living area	0.9968	0.9905	0.9728	0.9180	0.7894	0.5890	0.4245	0.4598	0.6956	0.9338	0.9911	0.9977	(86)
MIT	20.3534	20.4807	20.6389	20.8095	20.9156	20.9516	20.9556	20.9554	20.9424	20.8119	20.5502	20.3320	(87)
Th 2	20.0680	20.0709	20.0737	20.0871	20.0896	20.1013	20.1013	20.1034	20.0968	20.0896	20.0845	20.0792	(88)
util rest of house	0.9955	0.9867	0.9624	0.8889	0.7305	0.5094	0.3382	0.3708	0.6142	0.9037	0.9870	0.9968	(89)
MIT 2	19.3191	19.4827	19.6818	19.8941	20.0037	20.0428	20.0447	20.0469	20.0330	19.9034	19.5834	19.3012	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.4873	19.6450	19.8375	20.0430	20.1519	20.1906	20.1928	20.1946	20.1809	20.0511	19.7406	19.4688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4873	19.6450	19.8375	20.0430	20.1519	20.1906	20.1928	20.1946	20.1809	20.0511	19.7406	19.4688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9845	0.9591	0.8873	0.7349	0.5175	0.3470	0.3799	0.6221	0.9021	0.9849	0.9960	(94)
Useful gains	883.5181	1015.4432	1081.5631	1051.6154	885.6016	599.6769	387.0807	407.6273	649.1633	871.3152	859.8537	836.4111	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1703.5376	1648.2797	1485.9240	1221.7693	923.9192	602.5342	387.2236	407.8948	658.9800	1033.1446	1390.2430	1689.9630	(97)
Space heating kWh	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98a)
Space heating requirement - total per year (kWh/year)												2624.5481	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2624.5481	
Space heating per m2											(98c) / (4) =	23.8292	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	728.9062	508.0838	359.4319	146.3690	34.0601	0.0000	0.0000	0.0000	0.0000	143.8483	456.2488	758.7128	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5464	88.5202	88.4718	88.3792	88.2596	88.2000	88.2000	88.2000	88.2000	88.3765	88.5082	88.5519	(217)
Fuel for water heating, kWh/month	303.9372	268.3316	283.9061	246.7817	237.4299	211.7894	207.3689	216.9009	220.7130	248.3675	267.0466	300.1980	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3135.6608	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3012.7708	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000	(237)
Total delivered energy for all uses	6475.6852	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3135.6608	3.6400	114.1381	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3012.7708	3.6400	109.6649	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Total energy cost			369.7670	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8580	(257)
SAP value		86.0912	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3135.6608	0.2100	658.4888	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3012.7708	0.2100	632.6819	(264)
Space and water heating			1291.1706	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1337.9203	(272)
CO2 emissions per m2			12.1500	(273)
EI value			88.4439	
EI rating			88	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 110.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3839	0.3656	0.3656	0.3382	0.3382	0.3016	0.3108	0.2925	0.3016	0.3199	0.3199	0.3473	(22b)
Effective ac	0.5737	0.5668	0.5668	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5603	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	56.8629 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.1288	51.5063	51.5063	50.6294	50.6294	49.5665	49.8209	49.3198	49.5665	50.0828	50.0828	50.9141	(38)
Heat transfer coeff	108.9917	108.3691	108.3691	107.4923	107.4923	106.4294	106.6837	106.1827	106.4294	106.9457	106.9457	107.7770	(39)
Average = Sum(39)m / 12 =												107.3423	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9896	0.9839	0.9839	0.9760	0.9760	0.9663	0.9686	0.9641	0.9663	0.9710	0.9710	0.9785	(40)
HLP (average)												0.9746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8157 (42)
Hot water usage for mixer showers	71.4292 70.3558 68.7916 65.7987 63.5901 61.1270 59.7270 61.2794 62.9811 65.6257 68.6828	71.1556 (42a)
Hot water usage for baths	32.4633 31.9812 31.3022 30.0504 29.1130 28.0737 27.5122 28.1864 28.9205 30.0327 31.3103	32.3535 (42b)
Hot water usage for other uses	45.7529 44.0891 42.4254 40.7616 39.0979 37.4342 37.4342 39.0979 40.7616 42.4254 44.0891	45.7529 (42c)
Average daily hot water use (litres/day)		137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
									Total per year (kWh/year) = Sum(64)m =			2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													

	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	89.9970	90.5140	90.5140	91.2523	91.2523	92.1636	91.9439	92.3778	92.1636	91.7187	91.7187	91.0113	
alpha	6.9998	7.0343	7.0343	7.0835	7.0835	7.1442	7.1296	7.1585	7.1442	7.1146	7.1146	7.0674	
util living area	0.9948	0.9872	0.9617	0.8771	0.6963	0.4428	0.2883	0.3056	0.5705	0.8851	0.9831	0.9963	(86)
MIT	20.4490	20.5542	20.7102	20.8651	20.9410	20.9559	20.9564	20.9565	20.9533	20.8750	20.6490	20.4286	(87)
Th 2	20.0920	20.0968	20.0968	20.1034	20.1034	20.1115	20.1096	20.1134	20.1115	20.1076	20.1076	20.1013	(88)
util rest of house	0.9926	0.9821	0.9470	0.8374	0.6269	0.3646	0.2055	0.2209	0.4856	0.8388	0.9752	0.9947	(89)
MIT 2	19.4611	19.5974	19.7888	19.9688	20.0379	20.0555	20.0536	20.0576	20.0544	19.9863	19.7266	19.4431	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.6218	19.7530	19.9386	20.1146	20.1848	20.2019	20.2004	20.2038	20.2006	20.1309	19.8766	19.6034	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6218	19.7530	19.9386	20.1146	20.1848	20.2019	20.2004	20.2038	20.2006	20.1309	19.8766	19.6034	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9797	0.9439	0.8379	0.6334	0.3726	0.2140	0.2296	0.4943	0.8402	0.9726	0.9936	(94)
Useful gains	901.0180	1004.7178	1052.4656	997.9092	759.7924	446.9628	245.4114	255.2370	530.4143	828.4027	879.5191	850.0805	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1582.7506	1533.7476	1358.7989	1097.9883	772.3092	447.2063	245.4146	255.2423	532.2090	912.3376	1270.1520	1563.1306	(97)
Space heating kWh	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98a)
Space heating requirement - total per year (kWh/year)												2046.2111	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2046.2111	
Space heating per m2											(98c) / (4) =	18.5783	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	605.9845	424.7408	272.2963	86.0896	11.1261	0.0000	0.0000	0.0000	0.0000	74.6088	336.0283	633.8223	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5260	88.4991	88.4372	88.3236	88.2212	88.2000	88.2000	88.2000	88.2000	88.3103	88.4710	88.5325	(217)
Fuel for water heating, kWh/month	304.0070	268.3956	284.0173	246.9369	237.5333	211.7894	207.3689	216.9009	220.7130	248.5538	267.1589	300.2638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2444.6966	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.6387	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5785.5889	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2444.6966	6.3400	154.9938	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6387	6.3400	191.0647	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Total energy cost			544.1444	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2444.6966	0.2100	513.3863	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6387	0.2100	632.8641	(264)
Space and water heating			1146.2504	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1193.0000	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2444.6966	1.1300	2762.5072	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6387	1.1300	3405.4117	(278)
Space and water heating			6167.9189	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Total Primary energy kWh/year			6668.0625	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 88

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.9	-£ 214	-110 kg (9.2%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.5	-£ 28	-151 kg (12.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£214	1.00 kg/m²	B 91	B 89
Total Savings	£214	1.00 kg/m²		

Potential energy efficiency rating:	B 91
Potential environmental impact rating:	B 89

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£85	£85	£0
Mains gas	£459	£459	£0
Space heating	£290	£290	£0
Water heating	£191	£191	£0
Lighting	£63	£63	£0
Generated (PV)	-£0	-£214	£214
Total cost of fuels	£544	£330	£214
Total cost of uses	£544	£330	£214
Delivered energy	53 kWh/m²	45 kWh/m²	7 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.1 tonnes	0.1 tonnes
CO2 emissions per m²	11 kg/m²	10 kg/m²	1 kg/m²
Primary energy	61 kWh/m²	49 kWh/m²	11 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35312.1200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							320.6112	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000

R11 Upstands or kerbs of rooflights								10.0000	0.2400	2.4000			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.2721	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	56.8629	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	112.1689	111.7855	111.4097	109.6446	109.3143	107.7770	107.7770	107.4923	108.3691	109.3143	109.9824	110.6809	(39)
Average = Sum(39)m / 12 =												109.6430	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0184	1.0149	1.0115	0.9955	0.9925	0.9785	0.9785	0.9760	0.9839	0.9925	0.9986	1.0049	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers													
	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths													
	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses													
	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)											Total = Sum(45)m =	2284.6277	
Distribution loss (46)m = 0.15 x (45)m													
	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	87.4478	87.7477	88.0437	89.4611	89.7314	91.0113	91.0113	91.2523	90.5140	89.7314	89.1863	88.6235	
alpha	6.8299	6.8498	6.8696	6.9641	6.9821	7.0674	7.0674	7.0835	7.0343	6.9821	6.9458	6.9082	
util living area													
	0.9968	0.9905	0.9728	0.9180	0.7894	0.5890	0.4245	0.4598	0.6956	0.9338	0.9911	0.9977	(86)

MIT	20.3534	20.4807	20.6389	20.8095	20.9156	20.9516	20.9556	20.9554	20.9424	20.8119	20.5502	20.3320	(87)
Th 2	20.0680	20.0709	20.0737	20.0871	20.0896	20.1013	20.1013	20.1034	20.0968	20.0896	20.0845	20.0792	(88)
util rest of house													
	0.9955	0.9867	0.9624	0.8889	0.7305	0.5094	0.3382	0.3708	0.6142	0.9037	0.9870	0.9968	(89)
MIT 2	19.3191	19.4827	19.6818	19.8941	20.0037	20.0428	20.0447	20.0469	20.0330	19.9034	19.5834	19.3012	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.4873	19.6450	19.8375	20.0430	20.1519	20.1906	20.1928	20.1946	20.1809	20.0511	19.7406	19.4688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4873	19.6450	19.8375	20.0430	20.1519	20.1906	20.1928	20.1946	20.1809	20.0511	19.7406	19.4688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9845	0.9591	0.8873	0.7349	0.5175	0.3470	0.3799	0.6221	0.9021	0.9849	0.9960	(94)
Useful gains	883.5181	1015.4432	1081.5631	1051.6154	885.6016	599.6769	387.0807	407.6273	649.1633	871.3152	859.8537	836.4111	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1703.5376	1648.2797	1485.9240	1221.7693	923.9192	602.5342	387.2236	407.8948	658.9800	1033.1446	1390.2430	1689.9630	(97)
Space heating kWh													
	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98a)
Space heating requirement - total per year (kWh/year)												2624.5481	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2624.5481	
Space heating per m2											(98c) / (4) =	23.8292	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	610.0945	425.2661	300.8445	122.5108	28.5083	0.0000	0.0000	0.0000	0.0000	120.4010	381.8803	635.0426	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	728.9062	508.0838	359.4319	146.3690	34.0601	0.0000	0.0000	0.0000	0.0000	143.8483	456.2488	758.7128	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5464	88.5202	88.4718	88.3792	88.2596	88.2000	88.2000	88.2000	88.2000	88.3765	88.5082	88.5519	(217)
Fuel for water heating, kWh/month													
	303.9372	268.3316	283.9061	246.7817	237.4299	211.7894	207.3689	216.9009	220.7130	248.3675	267.0466	300.1980	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.3786	-49.9331	-74.0102	-85.8029	-94.6041	-89.0050	-87.8139	-81.8076	-71.5792	-58.1455	-38.2750	-29.5399	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3135.6608	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.2000	
Water heating fuel used												3012.7708	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-794.8951	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5680.7902	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3135.6608	3.6400	114.1381	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3012.7708	3.6400	109.6649	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-794.8951	16.4900	-131.0782	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-131.0782	(252)
Total energy cost			238.6888	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5539 (257)
SAP value		91.0217
SAP rating (Section 12)		91 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3135.6608	0.2100	658.4888	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3012.7708	0.2100	632.6819	(264)
Space and water heating			1291.1706	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-794.8951	0.1340	-106.4995	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-106.4995	(269)
Total CO2, kg/year			1231.4207	(272)
CO2 emissions per m2			11.1800	(273)
EI value			89.3638	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 110.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)

Adj infilt rate													
	0.3839	0.3656	0.3656	0.3382	0.3382	0.3016	0.3108	0.2925	0.3016	0.3199	0.3199	0.3473	(22b)
Effective ac	0.5737	0.5668	0.5668	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5603	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			55.0700	0.1300	7.1591	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5908			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	56.8629 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.1288	51.5063	51.5063	50.6294	50.6294	49.5665	49.8209	49.3198	49.5665	50.0828	50.0828	50.9141	(38)
Heat transfer coeff	108.9917	108.3691	108.3691	107.4923	107.4923	106.4294	106.6837	106.1827	106.4294	106.9457	106.9457	107.7770	(39)
Average = Sum(39)m / 12 =												107.3423	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9896	0.9839	0.9839	0.9760	0.9760	0.9663	0.9686	0.9641	0.9663	0.9710	0.9710	0.9785	(40)
HLP (average)												0.9746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)

Hot water usage for other uses

45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)

Average daily hot water use (litres/day)		137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	89.9970	90.5140	90.5140	91.2523	91.2523	92.1636	91.9439	92.3778	92.1636	91.7187	91.7187	91.0113	
alpha	6.9998	7.0343	7.0343	7.0835	7.0835	7.1442	7.1296	7.1585	7.1442	7.1146	7.1146	7.0674	
util living area													
	0.9948	0.9872	0.9617	0.8771	0.6963	0.4428	0.2883	0.3056	0.5705	0.8851	0.9831	0.9963	(86)
MIT	20.4490	20.5542	20.7102	20.8651	20.9410	20.9559	20.9564	20.9565	20.9533	20.8750	20.6490	20.4286	(87)
Th 2	20.0920	20.0968	20.0968	20.1034	20.1034	20.1115	20.1096	20.1134	20.1115	20.1076	20.1076	20.1013	(88)
util rest of house													
	0.9926	0.9821	0.9470	0.8374	0.6269	0.3646	0.2055	0.2209	0.4856	0.8388	0.9752	0.9947	(89)
MIT 2	19.4611	19.5974	19.7888	19.9688	20.0379	20.0555	20.0536	20.0576	20.0544	19.9863	19.7266	19.4431	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.6218	19.7530	19.9386	20.1146	20.1848	20.2019	20.2004	20.2038	20.2006	20.1309	19.8766	19.6034	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6218	19.7530	19.9386	20.1146	20.1848	20.2019	20.2004	20.2038	20.2006	20.1309	19.8766	19.6034	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9797	0.9439	0.8379	0.6334	0.3726	0.2140	0.2296	0.4943	0.8402	0.9726	0.9936	(94)
Useful gains	901.0180	1004.7178	1052.4656	997.9092	759.7924	446.9628	245.4114	255.2370	530.4143	828.4027	879.5191	850.0805	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1582.7506	1533.7476	1358.7989	1097.9883	772.3092	447.2063	245.4146	255.2423	532.2090	912.3376	1270.1520	1563.1306	(97)
Space heating kWh													
	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98a)
Space heating requirement - total per year (kWh/year)												2046.2111	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2046.2111	
Space heating per m2											(98c) / (4) =	18.5783	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	507.2090	355.5080	227.9120	72.0570	9.3126	0.0000	0.0000	0.0000	0.0000	62.4476	281.2557	530.5092	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	605.9845	424.7408	272.2963	86.0896	11.1261	0.0000	0.0000	0.0000	0.0000	74.6088	336.0283	633.8223	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5260	88.4991	88.4372	88.3236	88.2212	88.2000	88.2000	88.2000	88.2000	88.3103	88.4710	88.5325	(217)
Fuel for water heating, kWh/month													
	304.0070	268.3956	284.0173	246.9369	237.5333	211.7894	207.3689	216.9009	220.7130	248.5538	267.1589	300.2638	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.6764	-50.2882	-73.9321	-87.2982	-94.7995	-92.2799	-90.5508	-85.5073	-75.0244	-61.2253	-42.5719	-32.1633	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2444.6966	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.6387	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-823.3173	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4962.2716	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2444.6966	6.3400	154.9938	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6387	6.3400	191.0647	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	26.0000	-214.0625	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-214.0625	(252)
Total energy cost			330.0819	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2444.6966	0.2100	513.3863	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6387	0.2100	632.8641	(264)
Space and water heating			1146.2504	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	0.1340	-110.3483	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-110.3483	(269)
Total CO2, kg/year			1082.6517	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2444.6966	1.1300	2762.5072	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6387	1.1300	3405.4117	(278)
Space and water heating			6167.9189	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	1.4953	-1231.1093	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1231.1093	(283)
Total Primary energy kWh/year			5436.9532	(286)

Full SAP Calculation Printout

Plot Reference	Plot 5	**Issued on Date**	05/11/2026
Assessment Reference	Lean	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	87 B	**DER**	11.78	**TER**	9.49
Environmental	89 B	**% DER < TER**			-24.13
CO_2 Emissions (t/year)	1.12	**DFEE**	26.49	**TFEE**	32.98
Compliance Check	See BREL	**% DFEE < TFEE**			19.68
% DPER < TPER	-32.93	**DPER**	65.64	**TPER**	49.38

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3453	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280

E4 Jamb	25.2000	0.0060	0.1512		
E5 Ground floor (normal)	22.2100	0.0930	2.0655		
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000		
E16 Corner (normal)	10.0000	0.0350	0.3500		
E18 Party wall between dwellings	10.0000	0.0000	0.0000		
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.2721	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	52.1734	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)
Average = Sum(39)m / 12 =												103.2122	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)

Hot water usage for other uses

45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)

Average daily hot water use (litres/day) 137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
12Total per year (kWh/year)												2663	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	600.5726	616.0588	588.2643	566.4002	535.4382	511.8984	490.5875	491.5247	507.8292	529.3584	564.3063	587.1098	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	818.6138	979.3256	1069.3599	1145.0496	1174.3539	1143.9299	1100.7434	1055.8803	1021.9547	925.9991	823.8498	774.8300	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area	0.9978	0.9917	0.9752	0.9146	0.7743	0.5657	0.4066	0.4419	0.6759	0.9339	0.9927	0.9985	(86)
MIT	20.3798	20.5163	20.6660	20.8333	20.9280	20.9554	20.9579	20.9578	20.9488	20.8307	20.5753	20.3580	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house	0.9970	0.9885	0.9657	0.8856	0.7170	0.4923	0.3279	0.3605	0.5987	0.9045	0.9893	0.9979	(89)
MIT 2	19.3978	19.5729	19.7613	19.9664	20.0625	20.0920	20.0932	20.0949	20.0848	19.9694	19.6577	19.3773	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.5575	19.7263	19.9084	20.1074	20.2032	20.2324	20.2338	20.2352	20.2253	20.1094	19.8069	19.5368	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5575	19.7263	19.9084	20.1074	20.2032	20.2324	20.2338	20.2352	20.2253	20.1094	19.8069	19.5368	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9866	0.9628	0.8845	0.7216	0.4997	0.3360	0.3688	0.6064	0.9033	0.9876	0.9973	(94)
Useful gains	815.4850	966.2424	1029.5277	1012.7515	847.3573	571.6169	369.8036	389.4001	619.6636	836.4666	813.5939	772.7586	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1604.1658	1554.4941	1401.9860	1156.7549	875.5037	573.3162	369.8784	389.5479	626.2533	979.1059	1314.8023	1595.0884	(97)
Space heating kWh	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98a)
Space heating requirement - total per year (kWh/year)												2462.6231	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2462.6231	
Space heating per m2											(98c) / (4) =	22.3590	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	701.0496	472.2882	331.0740	123.8739	25.0191	0.0000	0.0000	0.0000	0.0000	126.7905	431.1470	730.9598	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5422	88.5117	88.4616	88.3605	88.2452	88.2000	88.2000	88.2000	88.2000	88.3623	88.5014	88.5480	(217)
Fuel for water heating, kWh/month	303.9515	268.3573	283.9389	246.8339	237.4686	211.7894	207.3689	216.9009	220.7130	248.4073	267.0669	300.2113	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2942.2020	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.0080	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6282.4636	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2942.2020	0.2100	617.8624	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.0080	0.2100	632.7317	(264)
Space and water heating			1250.5941	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1297.3437	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.7800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2942.2020	1.1300	3324.6883	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.0080	1.1300	3404.6990	(278)
Space and water heating			6729.3873	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Total Primary energy kWh/year			7229.5309	(286)
Dwelling Primary energy Rate (DPER)			65.6400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)

Main dwelling

Party Wall 1	49.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.5714 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)

Average = Sum(39)m / 12 = 112.3515

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 133.9628 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7346	142.6226	138.8328	133.0702	128.3905	123.3595	121.4261	125.1995	129.1791	134.4608	140.3122	145.3566	(44)
Energy conte	230.8079	203.0926	213.3808	182.1664	172.8383	151.6848	146.8543	155.0231	159.2908	182.4620	199.9005	227.5934	(45)

Energy content (annual) Total = Sum(45)m = 2225.0950

Distribution loss (46)m = 0.15 x (45)m

34.6212	30.4639	32.0071	27.3250	25.9257	22.7527	22.0282	23.2535	23.8936	27.3693	29.9851	34.1390	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

281.7668	249.1200	264.3397	231.4815	223.7972	200.9999	197.8132	205.9820	208.6058	233.4210	249.2156	278.5523	(62)
WWHRS -32.6545	-28.8799	-30.2413	-25.0410	-23.3373	-19.9699	-18.7186	-19.9054	-20.6617	-24.3578	-27.5944	-32.0498	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)

Total per year (kWh/year) = Sum(64)m = 2521.6834 (64)

12Total per year (kWh/year) 2522 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

89.4834	79.0351	83.6889	72.8991	70.2084	62.7640	61.5688	64.2849	65.2929	73.4084	78.7957	88.4145	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	120.2733	117.6118	112.4850	101.2487	94.3662	87.1722	82.7538	86.4045	90.6846	98.6671	109.4384	118.8367	(72)
Total internal gains	604.1336	619.7066	592.0590	570.4899	539.7148	516.3680	495.1634	495.9941	512.1762	533.4915	568.1553	590.7064	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains	180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)

Total gains	784.8783	920.8356	990.8620	1050.1598	1069.3423	1040.2889	1000.9505	963.8151	938.3591	862.2858	783.3032	746.3165	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area													
	0.9985	0.9952	0.9870	0.9549	0.8607	0.6639	0.4840	0.5230	0.7702	0.9633	0.9955	0.9989	(86)
MIT	20.0825	20.2502	20.4523	20.7106	20.9015	20.9866	20.9986	20.9977	20.9645	20.7286	20.3621	20.0607	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house													
	0.9979	0.9933	0.9815	0.9355	0.8084	0.5763	0.3839	0.4205	0.6870	0.9435	0.9933	0.9985	(89)
MIT 2	18.9834	19.1993	19.4570	19.7833	19.9930	20.0744	20.0804	20.0823	20.0563	19.8116	19.3535	18.9641	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9913	0.9781	0.9322	0.8129	0.5903	0.4002	0.4372	0.6994	0.9405	0.9914	0.9978	(94)
Useful gains	782.5354	912.8089	969.1325	978.9203	869.2718	614.0405	400.6002	421.4165	656.2723	811.0047	776.5724	744.6875	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1707.3201	1656.7522	1497.1005	1239.7121	945.5546	621.2292	401.0295	422.1929	678.0124	1048.6149	1399.3355	1694.3093	(97)
Space heating kWh													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98a)
Space heating requirement - total per year (kWh/year)												3156.9924	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3156.9924	
Space heating per m2											(98c) / (4) =	28.6635	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	744.6319	541.0496	425.1171	203.2144	61.4225	0.0000	0.0000	0.0000	0.0000	191.3225	485.2700	764.6305	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4392	86.0806	85.4814	84.1788	82.0514	80.3000	80.3000	80.3000	80.3000	84.0241	85.8584	86.5037	(217)
Fuel for water heating, kWh/month													
	288.1938	255.8533	273.8589	245.2404	244.3100	225.4421	223.0319	231.7269	234.0525	248.8132	258.1238	284.9617	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.8955	-69.5185	-98.7462	-109.6378	-117.0170	-108.7321	-107.3249	-101.8736	-92.1243	-78.7820	-54.5359	-43.2297	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-30.7378	-64.3592	-127.3927	-190.6055	-251.3652	-252.3802	-249.4675	-211.5728	-155.5027	-91.8621	-40.9751	-24.3346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3416.6585	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3013.6086	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.2536	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2721.9727	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4035.5479	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3416.6585	0.2100	717.4983	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6086	0.2100	632.8578	(264)
Space and water heating			1350.3561	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	0.1349	-139.0942	
PV Unit electricity exported	-1690.5552	0.1260	-213.0159	
Total			-352.1100	(269)
Total CO2, kg/year			1044.9956	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3416.6585	1.1300	3860.8241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6086	1.1300	3405.3777	(278)
Space and water heating			7266.2018	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	1.4984	-1545.5018	
PV Unit electricity exported	-1690.5552	0.4625	-781.9222	
Total			-2327.4240	(283)
Total Primary energy kWh/year			5438.9214	(286)
Target Primary Energy Rate (TPER)			49.3800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3453	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)

Average = Sum(39)m / 12 = 103.2122

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

	30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

	43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 68.1075 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)
									Total per year (kWh/year) = Sum(64)m =			961.4520	(64)
12Total per year (kWh/year)												961	(64)
Electric shower(s)	57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			650.6798	(64a)
Heat gains from water heating, kWh/month	39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)
Total internal gains													
	533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	751.7348	913.8642	1007.1181	1090.5117	1124.3613	1101.7334	1061.7997	1014.7322	978.1502	873.8457	764.3405	708.9947	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area													
	0.9987	0.9946	0.9821	0.9307	0.7991	0.5863	0.4214	0.4597	0.7021	0.9495	0.9954	0.9992	(86)
MIT	20.1764	20.3613	20.5678	20.8078	20.9514	20.9955	20.9996	20.9994	20.9846	20.8018	20.4436	20.1473	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house													
	0.9982	0.9924	0.9749	0.9053	0.7428	0.5107	0.3400	0.3751	0.6237	0.9250	0.9932	0.9988	(89)
MIT 2	19.3731	19.5585	19.7625	19.9943	20.1104	20.1454	20.1469	20.1485	20.1371	19.9952	19.6499	19.3514	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.5037	19.6891	19.8935	20.1266	20.2472	20.2836	20.2856	20.2869	20.2749	20.1264	19.7789	19.4808	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5037	19.6891	19.8935	20.1266	20.2472	20.2836	20.2856	20.2869	20.2749	20.1264	19.7789	19.4808	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9909	0.9725	0.9050	0.7504	0.5230	0.3532	0.3889	0.6362	0.9246	0.9919	0.9985	(94)
Useful gains	750.0150	905.5803	979.4186	986.8858	843.7688	576.2183	375.0439	394.5807	622.3168	807.9550	758.1555	707.8984	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1598.5142	1550.5873	1400.4260	1158.7387	880.0296	578.5296	375.1511	394.7960	631.3271	980.8474	1311.9034	1589.2703	(97)
Space heating kWh													
	631.2834	433.4447	313.2295	123.7341	26.9780	0.0000	0.0000	0.0000	0.0000	128.6320	398.6985	655.7407	(98a)
Space heating requirement - total per year (kWh/year)												2711.7409	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	631.2834	433.4447	313.2295	123.7341	26.9780	0.0000	0.0000	0.0000	0.0000	128.6320	398.6985	655.7407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2711.7409	
Space heating per m2											(98c) / (4) =	24.6209	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	956.8113	753.2344	771.9412	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9599	0.9868	0.9804	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.4647	743.3070	756.8460	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1224.1937	1180.4703	1128.3597	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	220.1249	325.2495	276.4061	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	55.0312	81.3124	69.1015	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												205.4451	(107)
Energy for space heating												24.6209	(99)
Energy for space cooling												1.8653	(108)
Total												26.4862	(109)
Fabric Energy Efficiency (DFEE)												26.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							320.6112	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	59.5714	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)
Average = Sum(39)m / 12 =												112.3515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)
Hot water usage for other uses	43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)
Average daily hot water use (litres/day)												68.1075	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)

Total per year (kWh/year) = Sum(64)m = 961.4520 (64)

12Total per year (kWh/year) 961 (64)

Electric shower(s)

57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 650.6798 (64a)

Heat gains from water heating, kWh/month

39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)

Water heating gains (Table 5)

52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)

Total internal gains

533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains 180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)
Total gains 714.4383	851.7264	924.8254	991.5322	1015.0731	993.6227	957.4309	918.1977	890.2077	805.9993	719.9449	676.8846	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area													
	0.9992	0.9970	0.9911	0.9656	0.8835	0.6907	0.5054	0.5480	0.7994	0.9737	0.9973	0.9994	(86)
MIT	20.0261	20.1958	20.4026	20.6738	20.8823	20.9831	20.9982	20.9970	20.9554	20.6914	20.3120	20.0048	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house													
	0.9988	0.9957	0.9871	0.9499	0.8352	0.6015	0.4012	0.4412	0.7178	0.9585	0.9959	0.9992	(89)
MIT 2	19.1619	19.3333	19.5404	19.8129	19.9963	20.0743	20.0804	20.0822	20.0561	19.8351	19.4608	19.1499	(90)

Living area fraction fLA = Living area / (4) = 0.1626 (91)

MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9946	0.9851	0.9476	0.8394	0.6158	0.4183	0.4587	0.7300	0.9564	0.9949	0.9989	(94)
Useful gains	713.2834	847.1295	911.0126	939.5380	852.0584	611.9108	400.4548	421.1315	649.8206	770.8953	716.2638	676.1139	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1723.4428	1668.5850	1504.1475	1241.8272	945.5118	621.1618	401.0211	422.1767	677.8303	1050.1441	1408.5437	1710.9207	(97)
Space heating kWh													
	751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98a)

Space heating requirement - total per year (kWh/year) 3508.1455

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3508.1455

Space heating per m2 (98c) / (4) = 31.8517 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1038.5632	817.5923	837.5257	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8966	0.9562	0.9412	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.1721	781.7868	788.2642	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1097.8306	1058.4808	1015.5271	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	119.9941	205.8604	169.0836	0.0000	0.0000	0.0000	0.0000	(104)

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)

	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.9985	51.4651	42.2709	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 123.7345 (107)
Energy for space heating 31.8517 (99)
Energy for space cooling 1.1234 (108)
Total 32.9751 (109)
Fabric Energy Efficiency (TFEE) 33.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3453 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280

E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)
Average = Sum(39)m / 12 =												103.2122	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
									Total per year (kWh/year) = Sum(64)m =			2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area													
	0.9964	0.9888	0.9672	0.9018	0.7593	0.5587	0.4012	0.4349	0.6634	0.9205	0.9897	0.9975	(86)
MIT	20.4219	20.5462	20.6955	20.8466	20.9315	20.9556	20.9579	20.9578	20.9498	20.8456	20.6037	20.3974	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house													
	0.9949	0.9846	0.9553	0.8703	0.7015	0.4860	0.3236	0.3547	0.5870	0.8875	0.9850	0.9965	(89)
MIT 2	19.4514	19.6103	19.7965	19.9802	20.0652	20.0921	20.0932	20.0949	20.0854	19.9849	19.6932	19.4276	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9823	0.9522	0.8697	0.7063	0.4934	0.3315	0.3629	0.5946	0.8869	0.9829	0.9956	(94)
Useful gains	883.0372	1013.1962	1073.8395	1030.6682	851.1795	571.7650	369.8108	389.4172	620.4989	856.5635	858.0902	836.1418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1609.6010	1558.2869	1405.5692	1158.1655	875.7966	573.3279	369.8790	389.5494	626.3181	980.6929	1318.3548	1600.1337	(97)
Space heating kWh													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98a)
Space heating requirement - total per year (kWh/year)												2255.9373	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2255.9373	
Space heating per m2											(98c) / (4) =	20.4825	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	645.8345	437.6355	294.8708	109.6751	21.8818	0.0000	0.0000	0.0000	0.0000	110.3372	395.9266	679.1039	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5332	88.5026	88.4471	88.3475	88.2400	88.2000	88.2000	88.2000	88.2000	88.3475	88.4912	88.5401	(217)
Fuel for water heating, kWh/month													
	303.9824	268.3847	283.9853	246.8701	237.4827	211.7894	207.3689	216.9009	220.7130	248.4490	267.0980	300.2381	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2695.2656	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.2625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)

Energy used	0.0000	(237)
Total delivered energy for all uses	6035.7817	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2695.2656	3.6400	98.1077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.2625	3.6400	109.6828	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Total energy cost			353.7545	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8209	(257)
SAP value		86.6935	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2695.2656	0.2100	566.0058	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.2625	0.2100	632.7851	(264)
Space and water heating			1198.7909	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1245.5405	(272)
CO2 emissions per m2			11.3100	(273)
EI value			89.2418	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3453	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3353	0.3194	0.3194	0.2954	0.2954	0.2635	0.2715	0.2555	0.2635	0.2795	0.2795	0.3034	(22b)
Effective ac	0.5562	0.5510	0.5510	0.5436	0.5436	0.5347	0.5368	0.5326	0.5347	0.5390	0.5390	0.5460	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5419	50.0669	50.0669	49.3978	49.3978	48.5869	48.7809	48.3986	48.5869	48.9808	48.9808	49.6151	(38)
Heat transfer coeff	102.7153	102.2403	102.2403	101.5712	101.5712	100.7602	100.9543	100.5720	100.7602	101.1541	101.1541	101.7884	(39)
Average = Sum(39)m / 12 =												101.4568	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9326	0.9283	0.9283	0.9222	0.9222	0.9148	0.9166	0.9131	0.9148	0.9184	0.9184	0.9242	(40)
HLP (average)												0.9212	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8157 (42)
Hot water usage for mixer showers	71.4292 70.3558 68.7916 65.7987 63.5901 61.1270 59.7270 61.2794 62.9811 65.6257 68.6828	71.1556 (42a)
Hot water usage for baths	32.4633 31.9812 31.3022 30.0504 29.1130 28.0737 27.5122 28.1864 28.9205 30.0327 31.3103	32.3535 (42b)
Hot water usage for other uses	45.7529 44.0891 42.4254 40.7616 39.0979 37.4342 37.4342 39.0979 40.7616 42.4254 44.0891	45.7529 (42c)
Average daily hot water use (litres/day)		137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
									Total per year (kWh/year) = Sum(64)m =			2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													

	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.4962	95.9399	95.9399	96.5719	96.5719	97.3491	97.1620	97.5314	97.3491	96.9701	96.9701	96.3658	
alpha	7.3664	7.3960	7.3960	7.4381	7.4381	7.4899	7.4775	7.5021	7.4899	7.4647	7.4647	7.4244	
util living area	0.9940	0.9850	0.9541	0.8560	0.6649	0.4196	0.2729	0.2895	0.5419	0.8653	0.9801	0.9958	(86)
MIT	20.5079	20.6097	20.7564	20.8914	20.9489	20.9582	20.9584	20.9585	20.9567	20.8979	20.6934	20.4849	(87)
Th 2	20.1399	20.1435	20.1435	20.1487	20.1487	20.1549	20.1534	20.1564	20.1549	20.1519	20.1519	20.1470	(88)
util rest of house	0.9916	0.9792	0.9375	0.8145	0.5995	0.3489	0.1984	0.2132	0.4644	0.8169	0.9711	0.9941	(89)
MIT 2	19.5766	19.7073	19.8856	20.0388	20.0895	20.1015	20.1000	20.1031	20.1009	20.0511	19.8200	19.5536	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9767	0.9349	0.8160	0.6059	0.3561	0.2059	0.2209	0.4723	0.8192	0.9686	0.9929	(94)
Useful gains	900.0945	1001.7259	1042.3826	971.8266	726.7646	427.1860	236.1915	245.6178	506.8526	807.7028	875.9244	849.5307	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1502.5233	1457.3393	1291.0098	1043.8892	734.2827	427.3067	236.1929	245.6201	507.8396	868.7911	1210.0106	1486.6233	(97)
Space heating kWh	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98a)
Space heating requirement - total per year (kWh/year)												1756.8250	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1756.8250	
Space heating per m2											(98c) / (4) =	15.9508	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	535.4922	365.7971	221.0019	61.9894	6.6827	0.0000	0.0000	0.0000	0.0000	54.3007	287.3860	566.3045	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5117	88.4809	88.4114	88.2956	88.2129	88.2000	88.2000	88.2000	88.2000	88.2854	88.4515	88.5197	(217)
Fuel for water heating, kWh/month	304.0560	268.4507	284.1001	247.0151	237.5555	211.7894	207.3689	216.9009	220.7130	248.6238	267.2178	300.3072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2098.9546	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3014.0985	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5440.3067	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2098.9546	6.3400	133.0737	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	6.3400	191.0938	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Total energy cost			522.2535	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2098.9546	0.2100	440.7805	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3014.0985	0.2100	632.9607	(264)
Space and water heating			1073.7411	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Total CO2, kg/year			1120.4908	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2098.9546	1.1300	2371.8187	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	1.1300	3405.9313	(278)
Space and water heating			5777.7500	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Total Primary energy kWh/year			6277.8936	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.9	-£ 214	-110 kg (9.8%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.5	-£ 28	-151 kg (13.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£214	1.00 kg/m²	A 92	B 90
Total Savings	£214	1.00 kg/m²		

Potential energy efficiency rating:	A 92
Potential environmental impact rating:	B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£85	£85	£0
Mains gas	£437	£437	£0
Space heating	£268	£268	£0
Water heating	£191	£191	£0
Lighting	£63	£63	£0
Generated (PV)	-£0	-£214	£214
Total cost of fuels	£522	£308	£214
Total cost of uses	£522	£308	£214
Delivered energy	49 kWh/m²	42 kWh/m²	7 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.0 tonnes	0.1 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	1 kg/m²
Primary energy	57 kWh/m²	46 kWh/m²	11 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3453 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		35312.1200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							320.6112	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000

R11 Upstands or kerbs of rooflights									10.0000	0.2400	2.4000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.2721	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	52.1734	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)
Average = Sum(39)m / 12 =												103.2122	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)											Total = Sum(45)m =	2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area	0.9964	0.9888	0.9672	0.9018	0.7593	0.5587	0.4012	0.4349	0.6634	0.9205	0.9897	0.9975	(86)

MIT	20.4219	20.5462	20.6955	20.8466	20.9315	20.9556	20.9579	20.9578	20.9498	20.8456	20.6037	20.3974	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house	0.9949	0.9846	0.9553	0.8703	0.7015	0.4860	0.3236	0.3547	0.5870	0.8875	0.9850	0.9965	(89)
MIT 2	19.4514	19.6103	19.7965	19.9802	20.0652	20.0921	20.0932	20.0949	20.0854	19.9849	19.6932	19.4276	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9823	0.9522	0.8697	0.7063	0.4934	0.3315	0.3629	0.5946	0.8869	0.9829	0.9956	(94)
Useful gains	883.0372	1013.1962	1073.8395	1030.6682	851.1795	571.7650	369.8108	389.4172	620.4989	856.5635	858.0902	836.1418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1609.6010	1558.2869	1405.5692	1158.1655	875.7966	573.3279	369.8790	389.5494	626.3181	980.6929	1318.3548	1600.1337	(97)
Space heating kWh	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98a)
Space heating requirement - total per year (kWh/year)												2255.9373	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2255.9373	
Space heating per m2											(98c) / (4) =	20.4825	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	645.8345	437.6355	294.8708	109.6751	21.8818	0.0000	0.0000	0.0000	0.0000	110.3372	395.9266	679.1039	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5332	88.5026	88.4471	88.3475	88.2400	88.2000	88.2000	88.2000	88.2000	88.3475	88.4912	88.5401	(217)
Fuel for water heating, kWh/month	303.9824	268.3847	283.9853	246.8701	237.4827	211.7894	207.3689	216.9009	220.7130	248.4490	267.0980	300.2381	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.3786	-49.9331	-74.0102	-85.8029	-94.6041	-89.0050	-87.8139	-81.8076	-71.5792	-58.1455	-38.2750	-29.5399	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2695.2656	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.2000	
Water heating fuel used												3013.2625	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-794.8951	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												5240.8866	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2695.2656	3.6400	98.1077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.2625	3.6400	109.6828	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-794.8951	16.4900	-131.0782	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-131.0782	(252)
Total energy cost			222.6763	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5167 (257)
SAP value		91.6240
SAP rating (Section 12)		92 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2695.2656	0.2100	566.0058	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.2625	0.2100	632.7851	(264)
Space and water heating			1198.7909	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-794.8951	0.1340	-106.4995	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-106.4995	(269)
Total CO2, kg/year			1139.0410	(272)
CO2 emissions per m2			10.3400	(273)
EI value			90.1617	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3453 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)

Adj infilt rate													
	0.3353	0.3194	0.3194	0.2954	0.2954	0.2635	0.2715	0.2555	0.2635	0.2795	0.2795	0.3034	(22b)
Effective ac	0.5562	0.5510	0.5510	0.5436	0.5436	0.5347	0.5368	0.5326	0.5347	0.5390	0.5390	0.5460	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	52.1734	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5419	50.0669	50.0669	49.3978	49.3978	48.5869	48.7809	48.3986	48.5869	48.9808	48.9808	49.6151	(38)
Heat transfer coeff	102.7153	102.2403	102.2403	101.5712	101.5712	100.7602	100.9543	100.5720	100.7602	101.1541	101.1541	101.7884	(39)
Average = Sum(39)m / 12 =												101.4568	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9326	0.9283	0.9283	0.9222	0.9222	0.9148	0.9166	0.9131	0.9148	0.9184	0.9184	0.9242	(40)
HLP (average)												0.9212	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8157	(42)
Hot water usage for mixer showers	71.4292 70.3558 68.7916 65.7987 63.5901 61.1270 59.7270 61.2794 62.9811 65.6257 68.6828	71.1556	(42a)
Hot water usage for baths	32.4633 31.9812 31.3022 30.0504 29.1130 28.0737 27.5122 28.1864 28.9205 30.0327 31.3103	32.3535	(42b)
Hot water usage for other uses	45.7529 44.0891 42.4254 40.7616 39.0979 37.4342 37.4342 39.0979 40.7616 42.4254 44.0891	45.7529	(42c)
Average daily hot water use (litres/day)		137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
									Total per year (kWh/year) = Sum(64)m =			2662.8485	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.4962	95.9399	95.9399	96.5719	96.5719	97.3491	97.1620	97.5314	97.3491	96.9701	96.9701	96.3658	
alpha	7.3664	7.3960	7.3960	7.4381	7.4381	7.4899	7.4775	7.5021	7.4899	7.4647	7.4647	7.4244	
util living area													
	0.9940	0.9850	0.9541	0.8560	0.6649	0.4196	0.2729	0.2895	0.5419	0.8653	0.9801	0.9958	(86)
MIT	20.5079	20.6097	20.7564	20.8914	20.9489	20.9582	20.9584	20.9585	20.9567	20.8979	20.6934	20.4849	(87)
Th 2	20.1399	20.1435	20.1435	20.1487	20.1487	20.1549	20.1534	20.1564	20.1549	20.1519	20.1519	20.1470	(88)
util rest of house													
	0.9916	0.9792	0.9375	0.8145	0.5995	0.3489	0.1984	0.2132	0.4644	0.8169	0.9711	0.9941	(89)
MIT 2	19.5766	19.7073	19.8856	20.0388	20.0895	20.1015	20.1000	20.1031	20.1009	20.0511	19.8200	19.5536	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9767	0.9349	0.8160	0.6059	0.3561	0.2059	0.2209	0.4723	0.8192	0.9686	0.9929	(94)
Useful gains	900.0945	1001.7259	1042.3826	971.8266	726.7646	427.1860	236.1915	245.6178	506.8526	807.7028	875.9244	849.5307	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1502.5233	1457.3393	1291.0098	1043.8892	734.2827	427.3067	236.1929	245.6201	507.8396	868.7911	1210.0106	1486.6233	(97)
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98a)
Space heating requirement - total per year (kWh/year)												1756.8250	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1756.8250	
Space heating per m2											(98c) / (4) =	15.9508	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	535.4922	365.7971	221.0019	61.9894	6.6827	0.0000	0.0000	0.0000	0.0000	54.3007	287.3860	566.3045	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5117	88.4809	88.4114	88.2956	88.2129	88.2000	88.2000	88.2000	88.2000	88.2854	88.4515	88.5197	(217)
Fuel for water heating, kWh/month													
	304.0560	268.4507	284.1001	247.0151	237.5555	211.7894	207.3689	216.9009	220.7130	248.6238	267.2178	300.3072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.6764	-50.2882	-73.9321	-87.2982	-94.7995	-92.2799	-90.5508	-85.5073	-75.0244	-61.2253	-42.5719	-32.1633	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2098.9546	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3014.0985	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-823.3173	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4616.9894	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2098.9546	6.3400	133.0737	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	6.3400	191.0938	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	26.0000	-214.0625	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-214.0625	(252)
Total energy cost			308.1910	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2098.9546	0.2100	440.7805	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3014.0985	0.2100	632.9607	(264)
Space and water heating			1073.7411	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	0.1340	-110.3483	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-110.3483	(269)
Total CO2, kg/year			1010.1425	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2098.9546	1.1300	2371.8187	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	1.1300	3405.9313	(278)
Space and water heating			5777.7500	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.3173	1.4953	-1231.1093	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1231.1093	(283)
Total Primary energy kWh/year			5046.7843	(286)

Full SAP Calculation Printout

Plot Reference	Plot 5	**Issued on Date**	05/11/2026
Assessment Reference	Green	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	99 A	**DER**	7.73	**TER**	9.49
Environmental	93 A	**% DER < TER**			18.55
CO_2 Emissions (t/year)	0.65	**DFEE**	26.49	**TFEE**	32.98
Compliance Check	See BREL	**% DFEE < TFEE**			19.68
% DPER < TPER	18.48	**DPER**	40.25	**TPER**	49.38

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		4 * 10 =	40.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.1453	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.3453	(18)
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280

E4 Jamb	25.2000	0.0060	0.1512		
E5 Ground floor (normal)	22.2100	0.0930	2.0655		
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000		
E16 Corner (normal)	10.0000	0.0350	0.3500		
E18 Party wall between dwellings	10.0000	0.0000	0.0000		
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.2721	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	52.1734	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)
Average = Sum(39)m / 12 =												103.2122	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)

Hot water usage for other uses

45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)

Average daily hot water use (litres/day) 137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
12Total per year (kWh/year)												2663	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	600.5726	616.0588	588.2643	566.4002	535.4382	511.8984	490.5875	491.5247	507.8292	529.3584	564.3063	587.1098	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	818.6138	979.3256	1069.3599	1145.0496	1174.3539	1143.9299	1100.7434	1055.8803	1021.9547	925.9991	823.8498	774.8300	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area													
	0.9978	0.9917	0.9752	0.9146	0.7743	0.5657	0.4066	0.4419	0.6759	0.9339	0.9927	0.9985	(86)
MIT	20.3798	20.5163	20.6660	20.8333	20.9280	20.9554	20.9579	20.9578	20.9488	20.8307	20.5753	20.3580	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house													
	0.9970	0.9885	0.9657	0.8856	0.7170	0.4923	0.3279	0.3605	0.5987	0.9045	0.9893	0.9979	(89)
MIT 2	19.3978	19.5729	19.7613	19.9664	20.0625	20.0920	20.0932	20.0949	20.0848	19.9694	19.6577	19.3773	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.5575	19.7263	19.9084	20.1074	20.2032	20.2324	20.2338	20.2352	20.2253	20.1094	19.8069	19.5368	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5575	19.7263	19.9084	20.1074	20.2032	20.2324	20.2338	20.2352	20.2253	20.1094	19.8069	19.5368	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9866	0.9628	0.8845	0.7216	0.4997	0.3360	0.3688	0.6064	0.9033	0.9876	0.9973	(94)
Useful gains	815.4850	966.2424	1029.5277	1012.7515	847.3573	571.6169	369.8036	389.4001	619.6636	836.4666	813.5939	772.7586	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1604.1658	1554.4941	1401.9860	1156.7549	875.5037	573.3162	369.8784	389.5479	626.2533	979.1059	1314.8023	1595.0884	(97)
Space heating kWh													
	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98a)
Space heating requirement - total per year (kWh/year)												2462.6231	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2462.6231	
Space heating per m2											(98c) / (4) =	22.3590	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	586.7785	395.3052	277.1090	103.6824	20.9410	0.0000	0.0000	0.0000	0.0000	106.1236	360.8701	611.8133	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	701.0496	472.2882	331.0740	123.8739	25.0191	0.0000	0.0000	0.0000	0.0000	126.7905	431.1470	730.9598	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5422	88.5117	88.4616	88.3605	88.2452	88.2000	88.2000	88.2000	88.2000	88.3623	88.5014	88.5480	(217)
Fuel for water heating, kWh/month													
	303.9515	268.3573	283.9389	246.8339	237.4686	211.7894	207.3689	216.9009	220.7130	248.4073	267.0669	300.2113	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.5941	-80.2290	-112.0954	-122.1909	-128.3652	-118.5292	-116.9346	-111.9483	-102.6746	-89.7910	-63.5021	-50.9162	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-41.5789	-86.9309	-172.5971	-259.3532	-343.0004	-344.8982	-340.3685	-287.5996	-210.2515	-123.9007	-55.3175	-32.9115	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2942.2020	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.0080	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2827.9848	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2942.2020	0.2100	617.8624	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.0080	0.2100	632.7317	(264)
Space and water heating			1250.5941	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	0.1353	-156.3231	
PV Unit electricity exported	-2298.7081	0.1259	-289.4770	
Total			-445.8001	(269)
Total CO2, kg/year			851.5436	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.7300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2942.2020	1.1300	3324.6883	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.0080	1.1300	3404.6990	(278)
Space and water heating			6729.3873	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	1.4999	-1733.5577	
PV Unit electricity exported	-2298.7081	0.4623	-1062.5790	
Total			-2796.1367	(283)
Total Primary energy kWh/year			4433.3942	(286)
Dwelling Primary energy Rate (DPER)			40.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3953 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 59.5714 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)
Average = Sum(39)m / 12 =												112.3515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)

Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 133.9628 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.7346	142.6226	138.8328	133.0702	128.3905	123.3595	121.4261	125.1995	129.1791	134.4608	140.3122	145.3566	(44)
Energy conte	230.8079	203.0926	213.3808	182.1664	172.8383	151.6848	146.8543	155.0231	159.2908	182.4620	199.9005	227.5934	(45)
Energy content (annual)										Total = Sum(45)m =		2225.0950	
Distribution loss (46)m = 0.15 x (45)m	34.6212	30.4639	32.0071	27.3250	25.9257	22.7527	22.0282	23.2535	23.8936	27.3693	29.9851	34.1390	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	281.7668	249.1200	264.3397	231.4815	223.7972	200.9999	197.8132	205.9820	208.6058	233.4210	249.2156	278.5523	(62)
WWHRS	-32.6545	-28.8799	-30.2413	-25.0410	-23.3373	-19.9699	-18.7186	-19.9054	-20.6617	-24.3578	-27.5944	-32.0498	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)
									Total per year (kWh/year) = Sum(64)m =			2521.6834	(64)
12Total per year (kWh/year)												2522	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	89.4834	79.0351	83.6889	72.8991	70.2084	62.7640	61.5688	64.2849	65.2929	73.4084	78.7957	88.4145	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	120.2733	117.6118	112.4850	101.2487	94.3662	87.1722	82.7538	86.4045	90.6846	98.6671	109.4384	118.8367	(72)
Total internal gains	604.1336	619.7066	592.0590	570.4899	539.7148	516.3680	495.1634	495.9941	512.1762	533.4915	568.1553	590.7064	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains	180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)
Total gains	784.8783	920.8356	990.8620	1050.1598	1069.3423	1040.2889	1000.9505	963.8151	938.3591	862.2858	783.3032	746.3165	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area	0.9985	0.9952	0.9870	0.9549	0.8607	0.6639	0.4840	0.5230	0.7702	0.9633	0.9955	0.9989	(86)
MIT	20.0825	20.2502	20.4523	20.7106	20.9015	20.9866	20.9986	20.9977	20.9645	20.7286	20.3621	20.0607	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house	0.9979	0.9933	0.9815	0.9355	0.8084	0.5763	0.3839	0.4205	0.6870	0.9435	0.9933	0.9985	(89)
MIT 2	18.9834	19.1993	19.4570	19.7833	19.9930	20.0744	20.0804	20.0823	20.0563	19.8116	19.3535	18.9641	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1621	19.3702	19.6189	19.9341	20.1407	20.2227	20.2297	20.2311	20.2040	19.9607	19.5175	19.1424	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9913	0.9781	0.9322	0.8129	0.5903	0.4002	0.4372	0.6994	0.9405	0.9914	0.9978	(94)
Useful gains	782.5354	912.8089	969.1325	978.9203	869.2718	614.0405	400.6002	421.4165	656.2723	811.0047	776.5724	744.6875	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1707.3201	1656.7522	1497.1005	1239.7121	945.5546	621.2292	401.0295	422.1929	678.0124	1048.6149	1399.3355	1694.3093	(97)
Space heating kWh	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98a)
Space heating requirement - total per year (kWh/year)												3156.9924	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3156.9924	
Space heating per m2											(98c) / (4) =	28.6635	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.4000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	688.0398	499.9298	392.8082	187.7701	56.7544	0.0000	0.0000	0.0000	0.0000	176.7820	448.3895	706.5186	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	744.6319	541.0496	425.1171	203.2144	61.4225	0.0000	0.0000	0.0000	0.0000	191.3225	485.2700	764.6305	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	249.1124	220.2401	234.0984	206.4404	200.4598	181.0300	179.0946	186.0767	187.9442	209.0631	221.6211	246.5025	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.4392	86.0806	85.4814	84.1788	82.0514	80.3000	80.3000	80.3000	80.3000	84.0241	85.8584	86.5037	(217)
Fuel for water heating, kWh/month	288.1938	255.8533	273.8589	245.2404	244.3100	225.4421	223.0319	231.7269	234.0525	248.8132	258.1238	284.9617	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.8955	-69.5185	-98.7462	-109.6378	-117.0170	-108.7321	-107.3249	-101.8736	-92.1243	-78.7820	-54.5359	-43.2297	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-30.7378	-64.3592	-127.3927	-190.6055	-251.3652	-252.3802	-249.4675	-211.5728	-155.5027	-91.8621	-40.9751	-24.3346	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3416.6585	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3013.6086	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2721.9727	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4035.5479	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3416.6585	0.2100	717.4983	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.6086	0.2100	632.8578	(264)
Space and water heating			1350.3561	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	0.1349	-139.0942	
PV Unit electricity exported	-1690.5552	0.1260	-213.0159	
Total			-352.1100	(269)
Total CO2, kg/year			1044.9956	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3416.6585	1.1300	3860.8241	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.6086	1.1300	3405.3777	(278)
Space and water heating			7266.2018	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1031.4175	1.4984	-1545.5018	
PV Unit electricity exported	-1690.5552	0.4625	-781.9222	
Total			-2327.4240	(283)
Total Primary energy kWh/year			5438.9214	(286)
Target Primary Energy Rate (TPER)			49.3800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 110.1400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3453	(18)
Number of sides sheltered		1	(19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)

Average = Sum(39)m / 12 = 103.2122

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)

Hot water usage for other uses

43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)

Average daily hot water use (litres/day) 68.1075 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)
									Total per year (kWh/year) = Sum(64)m =			961.4520	(64)
12Total per year (kWh/year)												961	(64)
Electric shower(s)	57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						650.6798	(64a)
Heat gains from water heating, kWh/month	39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)

Water heating gains (Table 5)

	52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)

Total internal gains

	533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	751.7348	913.8642	1007.1181	1090.5117	1124.3613	1101.7334	1061.7997	1014.7322	978.1502	873.8457	764.3405	708.9947	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area	0.9987	0.9946	0.9821	0.9307	0.7991	0.5863	0.4214	0.4597	0.7021	0.9495	0.9954	0.9992	(86)
MIT	20.1764	20.3613	20.5678	20.8078	20.9514	20.9955	20.9996	20.9994	20.9846	20.8018	20.4436	20.1473	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house	0.9982	0.9924	0.9749	0.9053	0.7428	0.5107	0.3400	0.3751	0.6237	0.9250	0.9932	0.9988	(89)
MIT 2	19.3731	19.5585	19.7625	19.9943	20.1104	20.1454	20.1469	20.1485	20.1371	19.9952	19.6499	19.3514	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.5037	19.6891	19.8935	20.1266	20.2472	20.2836	20.2856	20.2869	20.2749	20.1264	19.7789	19.4808	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5037	19.6891	19.8935	20.1266	20.2472	20.2836	20.2856	20.2869	20.2749	20.1264	19.7789	19.4808	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9909	0.9725	0.9050	0.7504	0.5230	0.3532	0.3889	0.6362	0.9246	0.9919	0.9985	(94)
Useful gains	750.0150	905.5803	979.4186	986.8858	843.7688	576.2183	375.0439	394.5807	622.3168	807.9550	758.1555	707.8984	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1598.5142	1550.5873	1400.4260	1158.7387	880.0296	578.5296	375.1511	394.7960	631.3271	980.8474	1311.9034	1589.2703	(97)
Space heating kWh	631.2834	433.4447	313.2295	123.7341	26.9780	0.0000	0.0000	0.0000	0.0000	128.6320	398.6985	655.7407	(98a)
Space heating requirement - total per year (kWh/year)												2711.7409	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	631.2834	433.4447	313.2295	123.7341	26.9780	0.0000	0.0000	0.0000	0.0000	128.6320	398.6985	655.7407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2711.7409	
Space heating per m2											(98c) / (4) =	24.6209	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	956.8113	753.2344	771.9412	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9599	0.9868	0.9804	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.4647	743.3070	756.8460	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1224.1937	1180.4703	1128.3597	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	220.1249	325.2495	276.4061	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	55.0312	81.3124	69.1015	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												205.4451	(107)
Energy for space heating												24.6209	(99)
Energy for space cooling												1.8653	(108)
Total												26.4862	(109)
Fabric Energy Efficiency (DFEE)												26.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3953	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3656	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4662	0.4570	0.4479	0.4022	0.3930	0.3473	0.3473	0.3382	0.3656	0.3930	0.4113	0.4296	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6087	0.6044	0.6003	0.5809	0.5772	0.5603	0.5603	0.5572	0.5668	0.5772	0.5846	0.5923	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
Heatloss Floor 1			55.0700	0.1300	7.1591			(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1800	16.5258			(29a)
External Roof 1	55.0700		55.0700	0.1100	6.0577			(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2128			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.3586	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	59.5714	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3060	54.9226	54.5468	52.7817	52.4514	50.9141	50.9141	50.6294	51.5063	52.4514	53.1195	53.8180	(38)
Heat transfer coeff	114.8773	114.4940	114.1182	112.3530	112.0228	110.4854	110.4854	110.2007	111.0776	112.0228	112.6909	113.3893	(39)
Average = Sum(39)m / 12 =												112.3515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0430	1.0395	1.0361	1.0201	1.0171	1.0031	1.0031	1.0006	1.0085	1.0171	1.0232	1.0295	(40)
HLP (average)												1.0201	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

	30.8401	30.3821	29.7371	28.5479	27.6574	26.6700	26.1366	26.7771	27.4745	28.5310	29.7448	30.7359	(42b)
Hot water usage for other uses													
	43.4652	41.8847	40.3041	38.7236	37.1430	35.5624	35.5624	37.1430	38.7236	40.3041	41.8847	43.4652	(42c)
Average daily hot water use (litres/day)												68.1075	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	74.3053	72.2668	70.0412	67.2714	64.8004	62.2324	61.6991	63.9201	66.1980	68.8351	71.6294	74.2011	(44)
Energy conte	117.6815	102.9069	107.6508	92.0912	87.2338	76.5220	74.6197	79.1464	81.6288	93.4086	102.0492	116.1810	(45)
Energy content (annual)										Total = Sum(45)m =		1131.1200	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	100.0293	87.4709	91.5031	78.2775	74.1487	65.0437	63.4267	67.2745	69.3845	79.3973	86.7419	98.7538	(64)
										Total per year (kWh/year) = Sum(64)m =		961.4520	(64)
12Total per year (kWh/year)												961	(64)
Electric shower(s)													
	57.2029	50.9683	55.6554	53.1113	54.1079	51.6137	53.3341	54.1079	53.1113	55.6554	54.6089	57.2029	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		650.6798	(64a)
Heat gains from water heating, kWh/month													
	39.3080	34.6098	36.7896	32.8472	32.0641	29.1643	29.1902	30.3456	30.6239	33.7632	35.3377	38.9892	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	143.8683	159.2828	143.8683	148.6639	143.8683	148.6639	143.8683	143.8683	148.6639	143.8683	148.6639	143.8683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	52.8334	51.5027	49.4484	45.6211	43.0970	40.5060	39.2342	40.7871	42.5332	45.3806	49.0801	52.4048	(72)
Total internal gains													
	533.6937	550.5974	526.0224	511.8623	485.4456	469.7019	451.6438	450.3767	464.0247	477.2049	504.7970	521.2745	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.6300	0.7000	0.7700	18.7183	(74)
South	11.3400	46.7521	0.6300	0.7000	0.7700	162.0264	(78)

Solar gains	180.7446	301.1290	398.8030	479.6699	529.6275	523.9208	505.7871	467.8210	426.1829	328.7943	215.1479	155.6102	(83)
Total gains	714.4383	851.7264	924.8254	991.5322	1015.0731	993.6227	957.4309	918.1977	890.2077	805.9993	719.9449	676.8846	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.3860	85.6720	85.9541	87.3045	87.5618	88.7802	88.7802	89.0096	88.3069	87.5618	87.0427	86.5066	
alpha	6.6924	6.7115	6.7303	6.8203	6.8375	6.9187	6.9187	6.9340	6.8871	6.8375	6.8028	6.7671	
util living area													
	0.9992	0.9970	0.9911	0.9656	0.8835	0.6907	0.5054	0.5480	0.7994	0.9737	0.9973	0.9994	(86)
MIT	20.0261	20.1958	20.4026	20.6738	20.8823	20.9831	20.9982	20.9970	20.9554	20.6914	20.3120	20.0048	(87)
Th 2	20.0476	20.0505	20.0533	20.0666	20.0691	20.0807	20.0807	20.0829	20.0762	20.0691	20.0641	20.0588	(88)
util rest of house													
	0.9988	0.9957	0.9871	0.9499	0.8352	0.6015	0.4012	0.4412	0.7178	0.9585	0.9959	0.9992	(89)
MIT 2	19.1619	19.3333	19.5404	19.8129	19.9963	20.0743	20.0804	20.0822	20.0561	19.8351	19.4608	19.1499	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3025	19.4736	19.6806	19.9529	20.1404	20.2221	20.2296	20.2310	20.2023	19.9744	19.5992	19.2889	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9946	0.9851	0.9476	0.8394	0.6158	0.4183	0.4587	0.7300	0.9564	0.9949	0.9989	(94)
Useful gains	713.2834	847.1295	911.0126	939.5380	852.0584	611.9108	400.4548	421.1315	649.8206	770.8953	716.2638	676.1139	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1723.4428	1668.5850	1504.1475	1241.8272	945.5118	621.1618	401.0211	422.1767	677.8303	1050.1441	1408.5437	1710.9207	(97)
Space heating kWh													
	751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98a)
Space heating requirement - total per year (kWh/year)												3508.1455	

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

751.5586	552.0181	441.2924	217.6482	69.5293	0.0000	0.0000	0.0000	0.0000	207.7611	498.4415	769.8963	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3508.1455

Space heating per m2 (98c) / (4) = 31.8517 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1038.5632	817.5923	837.5257	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8966	0.9562	0.9412	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.1721	781.7868	788.2642	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1097.8306	1058.4808	1015.5271	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.9941	205.8604	169.0836	0.0000	0.0000	0.0000	0.0000	(104)

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)

0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	29.9985	51.4651	42.2709	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 123.7345 (107)

Energy for space heating 31.8517 (99)

Energy for space cooling 1.1234 (108)

Total 32.9751 (109)

Fabric Energy Efficiency (TFEE) 33.0 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

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2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3453 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)

Internal Wall 1	112.0000	9.0000	1008.0000 (32c)
Internal Floor 1	55.0700	18.0000	991.2600 (32d)
Internal Ceiling 2	55.0700	9.0000	495.6300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 320.6112 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)

Average = Sum(39)m / 12 = 103.2122

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8157 (42)
Hot water usage for mixer showers

71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)

Hot water usage for other uses

45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)

Average daily hot water use (litres/day) 137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)

Energy content (annual) Total = Sum(45)m = 2284.6277
Distribution loss (46)m = 0.15 x (45)m

35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)

Water storage loss (or HIU loss):
Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)

Total heat required for water heating calculated for each month

269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)

Total per year (kWh/year) = Sum(64)m = 2662.8485 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202	(83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area	0.9964	0.9888	0.9672	0.9018	0.7593	0.5587	0.4012	0.4349	0.6634	0.9205	0.9897	0.9975	(86)
MIT	20.4219	20.5462	20.6955	20.8466	20.9315	20.9556	20.9579	20.9578	20.9498	20.8456	20.6037	20.3974	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house	0.9949	0.9846	0.9553	0.8703	0.7015	0.4860	0.3236	0.3547	0.5870	0.8875	0.9850	0.9965	(89)
MIT 2	19.4514	19.6103	19.7965	19.9802	20.0652	20.0921	20.0932	20.0949	20.0854	19.9849	19.6932	19.4276	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9823	0.9522	0.8697	0.7063	0.4934	0.3315	0.3629	0.5946	0.8869	0.9829	0.9956	(94)
Useful gains	883.0372	1013.1962	1073.8395	1030.6682	851.1795	571.7650	369.8108	389.4172	620.4989	856.5635	858.0902	836.1418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1609.6010	1558.2869	1405.5692	1158.1655	875.7966	573.3279	369.8790	389.5494	626.3181	980.6929	1318.3548	1600.1337	(97)
Space heating kWh	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98a)
Space heating requirement - total per year (kWh/year)												2255.9373	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2255.9373	
Space heating per m2										(98c) / (4) =		20.4825	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	645.8345	437.6355	294.8708	109.6751	21.8818	0.0000	0.0000	0.0000	0.0000	110.3372	395.9266	679.1039	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5332	88.5026	88.4471	88.3475	88.2400	88.2000	88.2000	88.2000	88.2000	88.3475	88.4912	88.5401	(217)
Fuel for water heating, kWh/month	303.9824	268.3847	283.9853	246.8701	237.4827	211.7894	207.3689	216.9009	220.7130	248.4490	267.0980	300.2381	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.5941	-80.2290	-112.0954	-122.1909	-128.3652	-118.5292	-116.9346	-111.9483	-102.6746	-89.7910	-63.5021	-50.9162	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-41.5789	-86.9309	-172.5971	-259.3532	-343.0004	-344.8982	-340.3685	-287.5996	-210.2515	-123.9007	-55.3175	-32.9115	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2695.2656	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.2000	
Water heating fuel used												3013.2625	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)

Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2581.3029	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2695.2656	3.6400	98.1077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.2625	3.6400	109.6828	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	16.4900	-190.5866	
PV Unit electricity exported	-2298.7081	5.5900	-128.4978	
Total			-319.0844	(252)
Total energy cost			34.6702	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.0805	(257)
SAP value		98.6959	
SAP rating (Section 12)		99	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2695.2656	0.2100	566.0058	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.2625	0.2100	632.7851	(264)
Space and water heating			1198.7909	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	0.1353	-156.3231	
PV Unit electricity exported	-2298.7081	0.1259	-289.4770	
Total			-445.8001	(269)
Total CO2, kg/year			799.7404	(272)
CO2 emissions per m2			7.2600	(273)
EI value			93.0924	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700	(1b) x	2.4000	(2b) =	132.1680	(1b) - (3b)
First floor	55.0700	(1c) x	2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.3500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.1453	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.3453	(18)
Number of sides sheltered												1	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate													
	0.3353	0.3194	0.3194	0.2954	0.2954	0.2635	0.2715	0.2555	0.2635	0.2795	0.2795	0.3034	(22b)
Effective ac	0.5562	0.5510	0.5510	0.5436	0.5436	0.5347	0.5368	0.5326	0.5347	0.5390	0.5390	0.5460	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5419	50.0669	50.0669	49.3978	49.3978	48.5869	48.7809	48.3986	48.5869	48.9808	48.9808	49.6151	(38)
Heat transfer coeff	102.7153	102.2403	102.2403	101.5712	101.5712	100.7602	100.9543	100.5720	100.7602	101.1541	101.1541	101.7884	(39)
Average = Sum(39)m / 12 =												101.4568	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9326	0.9283	0.9283	0.9222	0.9222	0.9148	0.9166	0.9131	0.9148	0.9184	0.9184	0.9242	(40)
HLP (average)												0.9212	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157	(42)
Hot water usage for mixer showers													
	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)
Hot water usage for baths													
	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)
Hot water usage for other uses													
	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)
Average daily hot water use (litres/day)												137.5475	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m													
	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.4962	95.9399	95.9399	96.5719	96.5719	97.3491	97.1620	97.5314	97.3491	96.9701	96.9701	96.3658	
alpha	7.3664	7.3960	7.3960	7.4381	7.4381	7.4899	7.4775	7.5021	7.4899	7.4647	7.4647	7.4244	
util living area													
	0.9940	0.9850	0.9541	0.8560	0.6649	0.4196	0.2729	0.2895	0.5419	0.8653	0.9801	0.9958	(86)
MIT	20.5079	20.6097	20.7564	20.8914	20.9489	20.9582	20.9584	20.9585	20.9567	20.8979	20.6934	20.4849	(87)
Th 2	20.1399	20.1435	20.1435	20.1487	20.1487	20.1549	20.1534	20.1564	20.1549	20.1519	20.1519	20.1470	(88)
util rest of house													
	0.9916	0.9792	0.9375	0.8145	0.5995	0.3489	0.1984	0.2132	0.4644	0.8169	0.9711	0.9941	(89)
MIT 2	19.5766	19.7073	19.8856	20.0388	20.0895	20.1015	20.1000	20.1031	20.1009	20.0511	19.8200	19.5536	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9767	0.9349	0.8160	0.6059	0.3561	0.2059	0.2209	0.4723	0.8192	0.9686	0.9929	(94)
Useful gains	900.0945	1001.7259	1042.3826	971.8266	726.7646	427.1860	236.1915	245.6178	506.8526	807.7028	875.9244	849.5307	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1502.5233	1457.3393	1291.0098	1043.8892	734.2827	427.3067	236.1929	245.6201	507.8396	868.7911	1210.0106	1486.6233	(97)
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98a)
Space heating requirement - total per year (kWh/year)												1756.8250	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1756.8250	
Space heating per m2											(98c) / (4) =	15.9508	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	535.4922	365.7971	221.0019	61.9894	6.6827	0.0000	0.0000	0.0000	0.0000	54.3007	287.3860	566.3045	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement

	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5117	88.4809	88.4114	88.2956	88.2129	88.2000	88.2000	88.2000	88.2000	88.2854	88.4515	88.5197	(217)
Fuel for water heating, kWh/month													
	304.0560	268.4507	284.1001	247.0151	237.5555	211.7894	207.3689	216.9009	220.7130	248.6238	267.2178	300.3072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-63.6005	-80.7123	-112.0024	-123.6839	-128.5316	-121.0320	-119.0366	-115.1069	-106.1458	-93.5893	-69.6683	-54.9888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-48.6930	-88.0645	-172.2392	-269.2249	-344.6627	-376.9844	-367.0215	-318.9460	-232.6340	-136.8763	-66.8273	-38.0471	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2098.9546	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3014.0985	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	1791.9874	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2098.9546	6.3400	133.0737	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	6.3400	191.0938	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	26.0000	-308.9056	
PV Unit electricity exported	-2460.2209	5.8100	-142.9388	
Total			-451.8444	(252)
Total energy cost			70.4091	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2098.9546	0.2100	440.7805	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3014.0985	0.2100	632.9607	(264)
Space and water heating			1073.7411	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	0.1354	-160.8601	
PV Unit electricity exported	-2460.2209	0.1255	-308.7269	
Total			-469.5870	(269)
Total CO2, kg/year			650.9038	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2098.9546	1.1300	2371.8187	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	1.1300	3405.9313	(278)
Space and water heating			5777.7500	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	1.5004	-1782.6489	
PV Unit electricity exported	-2460.2209	0.4605	-1133.0054	
Total			-2915.6543	(283)
Total Primary energy kWh/year			3362.2393	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 99
Current environmental impact rating: A 93

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Already installed
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.5	-£ 31	-151 kg (23.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 99
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£85	£85	£0
Mains gas	£437	£437	£0
Space heating	£268	£268	£0
Water heating	£191	£191	£0
Lighting	£63	£63	£0
Generated (PV)	-£452	-£452	£0
Total cost of fuels	£70	£70	£0
Total cost of uses	£70	£70	£0
Delivered energy	16 kWh/m²	16 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	31 kWh/m²	31 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	55.0700 (1b)	x	2.4000 (2b)	=	132.1680	(1b) - (3b)
First floor	55.0700 (1c)	x	2.6000 (2c)	=	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.3500	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3453 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
Effective ac	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9661	52.6736	52.3869	51.0401	50.7881	49.6151	49.6151	49.3978	50.0669	50.7881	51.2978	51.8308	(38)
Heat transfer coeff	105.1395	104.8470	104.5602	103.2134	102.9615	101.7884	101.7884	101.5712	102.2403	102.9615	103.4712	104.0041	(39)
Average = Sum(39)m / 12 =												103.2122	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9546	0.9519	0.9493	0.9371	0.9348	0.9242	0.9242	0.9222	0.9283	0.9348	0.9395	0.9443	(40)
HLP (average)												0.9371	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8157 (42)
Hot water usage for mixer showers												
	71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556 (42a)
Hot water usage for baths												
	32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535 (42b)
Hot water usage for other uses												
	45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529 (42c)
Average daily hot water use (litres/day)												137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m													
	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)												
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401 (72)
Total internal gains												
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	10.6334	0.7600	0.7000	0.7700	22.5808	(74)
South	11.3400	46.7521	0.7600	0.7000	0.7700	195.4604	(78)

Solar gains	218.0412	363.2668	481.0957	578.6494	638.9157	632.0315	610.1559	564.3555	514.1254	396.6408	259.5435	187.7202 (83)
Total gains	888.5358	1031.4036	1127.6877	1185.1375	1205.1160	1158.8817	1115.5342	1073.1006	1043.5441	965.8284	873.0049	839.7954 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	93.2944	93.5547	93.8112	95.0353	95.2679	96.3658	96.3658	96.5719	95.9399	95.2679	94.7986	94.3128	
alpha	7.2196	7.2370	7.2541	7.3357	7.3512	7.4244	7.4244	7.4381	7.3960	7.3512	7.3199	7.2875	
util living area													
	0.9964	0.9888	0.9672	0.9018	0.7593	0.5587	0.4012	0.4349	0.6634	0.9205	0.9897	0.9975	(86)
MIT	20.4219	20.5462	20.6955	20.8466	20.9315	20.9556	20.9579	20.9578	20.9498	20.8456	20.6037	20.3974	(87)
Th 2	20.1213	20.1236	20.1258	20.1361	20.1380	20.1470	20.1470	20.1487	20.1435	20.1380	20.1341	20.1300	(88)
util rest of house													
	0.9949	0.9846	0.9553	0.8703	0.7015	0.4860	0.3236	0.3547	0.5870	0.8875	0.9850	0.9965	(89)
MIT 2	19.4514	19.6103	19.7965	19.9802	20.0652	20.0921	20.0932	20.0949	20.0854	19.9849	19.6932	19.4276	(90)
Living area fraction									fLA = Living area / (4) =			0.1626	(91)
MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6092	19.7625	19.9427	20.1211	20.2061	20.2325	20.2338	20.2352	20.2259	20.1249	19.8413	19.5853	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9823	0.9522	0.8697	0.7063	0.4934	0.3315	0.3629	0.5946	0.8869	0.9829	0.9956	(94)
Useful gains	883.0372	1013.1962	1073.8395	1030.6682	851.1795	571.7650	369.8108	389.4172	620.4989	856.5635	858.0902	836.1418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1609.6010	1558.2869	1405.5692	1158.1655	875.7966	573.3279	369.8790	389.5494	626.3181	980.6929	1318.3548	1600.1337	(97)
Space heating kWh													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98a)
Space heating requirement - total per year (kWh/year)												2255.9373	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2255.9373	
Space heating per m2											(98c) / (4) =	20.4825	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	540.5635	366.3009	246.8069	91.7981	18.3151	0.0000	0.0000	0.0000	0.0000	92.3523	331.3905	568.4100	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	645.8345	437.6355	294.8708	109.6751	21.8818	0.0000	0.0000	0.0000	0.0000	110.3372	395.9266	679.1039	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5332	88.5026	88.4471	88.3475	88.2400	88.2000	88.2000	88.2000	88.2000	88.3475	88.4912	88.5401	(217)
Fuel for water heating, kWh/month													
	303.9824	268.3847	283.9853	246.8701	237.4827	211.7894	207.3689	216.9009	220.7130	248.4490	267.0980	300.2381	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.5941	-80.2290	-112.0954	-122.1909	-128.3652	-118.5292	-116.9346	-111.9483	-102.6746	-89.7910	-63.5021	-50.9162	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-41.5789	-86.9309	-172.5971	-259.3532	-343.0004	-344.8982	-340.3685	-287.5996	-210.2515	-123.9007	-55.3175	-32.9115	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2695.2656	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3013.2625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2581.3029	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2695.2656	3.6400	98.1077	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3013.2625	3.6400	109.6828	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	241.2536	16.4900	39.7827	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	16.4900	-190.5866	
PV Unit electricity exported	-2298.7081	5.5900	-128.4978	
Total			-319.0844	(252)
Total energy cost			34.6702	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.0805	(257)
SAP value		98.6959	
SAP rating (Section 12)		99	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2695.2656	0.2100	566.0058	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3013.2625	0.2100	632.7851	(264)
Space and water heating			1198.7909	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1155.7707	0.1353	-156.3231	
PV Unit electricity exported	-2298.7081	0.1259	-289.4770	
Total			-445.8001	(269)
Total CO2, kg/year			799.7404	(272)
CO2 emissions per m2			7.2600	(273)
EI value			93.0924	
EI rating			93	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		55.0700	(1b)	x 2.4000	(2b) =	132.1680	(1b) - (3b)
First floor		55.0700	(1c)	x 2.6000	(2c) =	143.1820	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400						(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 275.3500 (5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1453	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3453	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3353	0.3194	0.3194	0.2954	0.2954	0.2635	0.2715	0.2555	0.2635	0.2795	0.2795	0.3034	(22b)
Effective ac	0.5562	0.5510	0.5510	0.5436	0.5436	0.5347	0.5368	0.5326	0.5347	0.5390	0.5390	0.5460	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Heatloss Floor 1			55.0700	0.1200	6.6084	110.0000	6057.7000	(28a)
External Wall 1	110.8000	18.9900	91.8100	0.1600	14.6896	190.0000	17443.9000	(29a)
External Roof 1	55.0700		55.0700	0.1000	5.5070	9.0000	495.6300	(30)
Total net area of external elements Aum(A, m2)			220.9400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9012			(33)
Main dwelling								
Party Wall 1			49.0000	0.0000	0.0000	180.0000	8820.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Floor 1			55.0700			18.0000	991.2600	(32d)
Internal Ceiling 2			55.0700			9.0000	495.6300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	35312.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		320.6112 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.1734 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5419	50.0669	50.0669	49.3978	49.3978	48.5869	48.7809	48.3986	48.5869	48.9808	48.9808	49.6151	(38)
Heat transfer coeff	102.7153	102.2403	102.2403	101.5712	101.5712	100.7602	100.9543	100.5720	100.7602	101.1541	101.1541	101.7884	(39)
Average = Sum(39)m / 12 =												101.4568	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9326	0.9283	0.9283	0.9222	0.9222	0.9148	0.9166	0.9131	0.9148	0.9184	0.9184	0.9242	(40)
HLP (average)												0.9212	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8157 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
71.4292	70.3558	68.7916	65.7987	63.5901	61.1270	59.7270	61.2794	62.9811	65.6257	68.6828	71.1556	(42a)

Hot water usage for baths

32.4633	31.9812	31.3022	30.0504	29.1130	28.0737	27.5122	28.1864	28.9205	30.0327	31.3103	32.3535	(42b)

Hot water usage for other uses

45.7529	44.0891	42.4254	40.7616	39.0979	37.4342	37.4342	39.0979	40.7616	42.4254	44.0891	45.7529	(42c)

Average daily hot water use (litres/day)	137.5475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6454	146.4261	142.5192	136.6108	131.8010	126.6348	124.6734	128.5637	132.6632	138.0837	144.0822	149.2620	(44)
Energy conte	237.0017	208.5088	219.0467	187.0133	177.4295	155.7123	150.7817	159.1887	163.5870	187.3783	205.2715	233.7082	(45)
Energy content (annual)										Total = Sum(45)m =		2284.6277	
Distribution loss (46)m = 0.15 x (45)m	35.5503	31.2763	32.8570	28.0520	26.6144	23.3568	22.6173	23.8783	24.5381	28.1067	30.7907	35.0562	(46)

Water storage loss (or HIU loss):

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1236	29.0188	32.1301	31.0903	32.1251	31.0860	32.1177	32.1178	31.0819	32.1202	31.0866	32.1228	(61)
Total heat required for water heating calculated for each month												
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
										Total per year (kWh/year) = Sum(64)m =		2662.8485	(64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month												
	86.8340	76.5839	80.8656	69.9545	67.0266	59.5458	58.1643	60.9597	62.1632	70.3333	76.0244	85.7387	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.1519	30.3335	24.6688	18.6759	13.9604	11.7860	12.7352	16.5537	22.2183	28.2112	32.9267	35.1011	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)													
	116.7123	113.9641	108.6903	97.1590	90.0895	82.7025	78.1779	81.9351	86.3377	94.5340	105.5895	115.2401	(72)
Total internal gains													
	670.4947	668.1369	646.5920	606.4881	566.2003	526.8502	505.3782	508.7450	529.4187	569.1877	613.4614	652.0752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.7600	11.9814	0.7600	0.7000	0.7700	25.4435	(74)
South	11.3400	50.9848	0.7600	0.7000	0.7700	213.1566	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	238.6001	357.4349	468.4315	584.4508	633.3163	672.7879	641.5120	603.0174	543.7479	416.7776	290.8680	203.5218	(83)
Total gains	909.0948	1025.5718	1115.0236	1190.9389	1199.5166	1199.6382	1146.8902	1111.7624	1073.1666	985.9653	904.3294	855.5970	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.4962	95.9399	95.9399	96.5719	96.5719	97.3491	97.1620	97.5314	97.3491	96.9701	96.9701	96.3658	
alpha	7.3664	7.3960	7.3960	7.4381	7.4381	7.4899	7.4775	7.5021	7.4899	7.4647	7.4647	7.4244	
util living area													
	0.9940	0.9850	0.9541	0.8560	0.6649	0.4196	0.2729	0.2895	0.5419	0.8653	0.9801	0.9958	(86)
MIT	20.5079	20.6097	20.7564	20.8914	20.9489	20.9582	20.9584	20.9585	20.9567	20.8979	20.6934	20.4849	(87)
Th 2	20.1399	20.1435	20.1435	20.1487	20.1487	20.1549	20.1534	20.1564	20.1549	20.1519	20.1519	20.1470	(88)
util rest of house													
	0.9916	0.9792	0.9375	0.8145	0.5995	0.3489	0.1984	0.2132	0.4644	0.8169	0.9711	0.9941	(89)
MIT 2	19.5766	19.7073	19.8856	20.0388	20.0895	20.1015	20.1000	20.1031	20.1009	20.0511	19.8200	19.5536	(90)
Living area fraction										fLA = Living area / (4) =		0.1626	(91)
MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7280	19.8541	20.0272	20.1774	20.2292	20.2408	20.2396	20.2422	20.2401	20.1888	19.9620	19.7050	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9767	0.9349	0.8160	0.6059	0.3561	0.2059	0.2209	0.4723	0.8192	0.9686	0.9929	(94)
Useful gains	900.0945	1001.7259	1042.3826	971.8266	726.7646	427.1860	236.1915	245.6178	506.8526	807.7028	875.9244	849.5307	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1502.5233	1457.3393	1291.0098	1043.8892	734.2827	427.3067	236.1929	245.6201	507.8396	868.7911	1210.0106	1486.6233	(97)
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98a)
Space heating requirement - total per year (kWh/year)												1756.8250	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1756.8250	
Space heating per m2											(98c) / (4) =	15.9508	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)

Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	448.2070	306.1722	184.9786	51.8851	5.5934	0.0000	0.0000	0.0000	0.0000	45.4497	240.5421	473.9969	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	535.4922	365.7971	221.0019	61.9894	6.6827	0.0000	0.0000	0.0000	0.0000	54.3007	287.3860	566.3045	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	269.1253	237.5275	251.1768	218.1036	209.5547	186.7983	182.8994	191.3066	194.6689	219.4985	236.3581	265.8310	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5117	88.4809	88.4114	88.2956	88.2129	88.2000	88.2000	88.2000	88.2000	88.2854	88.4515	88.5197	(217)
Fuel for water heating, kWh/month													
	304.0560	268.4507	284.1001	247.0151	237.5555	211.7894	207.3689	216.9009	220.7130	248.6238	267.2178	300.3072	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.8930	23.9813	21.5925	15.8196	12.2195	9.9834	11.1470	14.4893	18.8202	24.6931	27.8908	30.7238	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-63.6005	-80.7123	-112.0024	-123.6839	-128.5316	-121.0320	-119.0366	-115.1069	-106.1458	-93.5893	-69.6683	-54.9888	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-48.6930	-88.0645	-172.2392	-269.2249	-344.6627	-376.9844	-367.0215	-318.9460	-232.6340	-136.8763	-66.8273	-38.0471	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2098.9546	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												88.2000	
Water heating fuel used												3014.0985	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												241.2536	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3648.3193	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1791.9874	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2098.9546	6.3400	133.0737	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	6.3400	191.0938	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	241.2536	26.0000	62.7259	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	26.0000	-308.9056	
PV Unit electricity exported	-2460.2209	5.8100	-142.9388	
Total			-451.8444	(252)
Total energy cost			70.4091	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2098.9546	0.2100	440.7805	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3014.0985	0.2100	632.9607	(264)
Space and water heating			1073.7411	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	241.2536	0.1443	34.8203	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	0.1354	-160.8601	
PV Unit electricity exported	-2460.2209	0.1255	-308.7269	
Total			-469.5870	(269)
Total CO2, kg/year			650.9038	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2098.9546	1.1300	2371.8187	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3014.0985	1.1300	3405.9313	(278)
Space and water heating			5777.7500	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	241.2536	1.5338	370.0428	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1188.0984	1.5004	-1782.6489	
PV Unit electricity exported	-2460.2209	0.4605	-1133.0054	
Total			-2915.6543	(283)
Total Primary energy kWh/year			3362.2393	(286)

Full SAP Calculation Printout

Plot Reference	Plot 6	**Issued on Date**	05/11/2026
Assessment Reference	Baseline	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	87 B	**DER**	11.09	**TER**	8.30
Environmental	89 B	**% DER < TER**			-33.61
CO_2 Emissions (t/year)	1.52	**DFEE**	29.04	**TFEE**	31.36
Compliance Check	See BREL	**% DFEE < TFEE**			7.38
% DPER < TPER	-42.73	**DPER**	61.73	**TPER**	43.25

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9981	0.9944	0.9823	0.9268	0.7880	0.5800	0.4237	0.4789	0.7549	0.9643	0.9951	0.9986	(86)
MIT	20.1000	20.2415	20.4479	20.7159	20.8817	20.9396	20.9472	20.9462	20.9102	20.6701	20.3414	20.0855	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9975	0.9928	0.9770	0.9067	0.7413	0.5139	0.3497	0.3998	0.6889	0.9503	0.9934	0.9981	(89)
MIT 2	19.1205	19.3034	19.5671	19.9054	20.0897	20.1520	20.1569	20.1585	20.1261	19.8586	19.4419	19.1104	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3128	19.4875	19.7400	20.0645	20.2451	20.3066	20.3120	20.3131	20.2800	20.0178	19.6184	19.3017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9909	0.9733	0.9024	0.7433	0.5211	0.3582	0.4089	0.6944	0.9461	0.9917	0.9975	(94)
Useful gains	852.7463	1004.6038	1126.7026	1208.9671	1078.8681	752.4601	493.7884	518.3634	790.2552	910.0077	842.6333	811.6679	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2086.2006	2019.7748	1826.6700	1514.4961	1155.4702	760.1502	494.4561	519.7894	827.9979	1273.4817	1703.7061	2069.1085	(97)
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98a)
Space heating requirement - total per year (kWh/year)												4223.5663	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4223.5663	
Space heating per m2											(98c) / (4) =	26.4585	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.6900	682.1950	520.7757	219.9809	56.9920	0.0000	0.0000	0.0000	0.0000	270.4246	619.9724	935.5358	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1096.4038	815.0477	622.1932	262.8206	68.0908	0.0000	0.0000	0.0000	0.0000	323.0879	740.7077	1117.7249	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5837	88.5677	88.5337	88.4471	88.3043	88.2000	88.2000	88.2000	88.2000	88.4720	88.5587	88.5865	(217)
Fuel for water heating, kWh/month	312.1379	275.5167	291.4106	253.1761	243.5668	217.2877	212.6934	222.5219	226.4890	254.6942	274.1108	308.2936	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 5046.0768 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3091.8986 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8568.4534	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5046.0768	0.2100	1059.6761	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3091.8986	0.2100	649.2987	(264)
Space and water heating			1708.9748	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1770.6229	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5046.0768	1.1300	5702.0668	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3091.8986	1.1300	3493.8454	(278)
Space and water heating			9195.9122	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9854.3848	(286)
Dwelling Primary energy Rate (DPER)			61.7300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East			11.3400	19.6403	0.6300	0.7000	0.7700	68.0663 (76)				
West			5.7600	19.6403	0.6300	0.7000	0.7700	34.5734 (80)				
North			0.2500	15.2954	0.6300	0.7000	1.0000	1.5177 (82)				
South			1.0000	47.0123	0.6300	0.7000	1.0000	18.6592 (82)				
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546 (83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965 (64)
Efficiency of water heater												80.3000 (216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279 (217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4813.0912 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5848 0.5815 0.5783 0.5632 0.5603 0.5471 0.5471 0.5447 0.5522 0.5603 0.5661 0.5721 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	137.3014	136.8634	136.4340	134.4173	134.0399	132.2834	132.2834	131.9581	132.9600	134.0399	134.8033	135.6013	(39)
Average = Sum(39)m / 12 =												134.4155	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8601	0.8574	0.8547	0.8421	0.8397	0.8287	0.8287	0.8267	0.8329	0.8397	0.8445	0.8495	(40)
HLP (average)												0.8420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.9320	73.1654	73.3957	74.4969	74.7066	75.6986	75.6986	75.8852	75.3134	74.7066	74.2836	73.8464	
alpha	5.8621	5.8777	5.8930	5.9665	5.9804	6.0466	6.0466	6.0590	6.0209	5.9804	5.9522	5.9231	
util living area													
	0.9988	0.9960	0.9862	0.9364	0.8025	0.5927	0.4332	0.4916	0.7729	0.9717	0.9966	0.9991	(86)
MIT	19.8379	20.0273	20.3055	20.6716	20.9049	20.9873	20.9983	20.9966	20.9437	20.6041	20.1584	19.8155	(87)
Th 2	20.2015	20.2039	20.2062	20.2170	20.2191	20.2285	20.2285	20.2303	20.2249	20.2191	20.2150	20.2107	(88)
util rest of house													
	0.9984	0.9948	0.9819	0.9182	0.7570	0.5260	0.3581	0.4112	0.7080	0.9601	0.9954	0.9988	(89)
MIT 2	19.1238	19.3144	19.5917	19.9520	20.1556	20.2225	20.2281	20.2292	20.1936	19.8961	19.4546	19.1087	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2640	19.4543	19.7318	20.0933	20.3027	20.3726	20.3792	20.3798	20.3408	20.0350	19.5927	19.2475	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9933	0.9787	0.9149	0.7622	0.5387	0.3728	0.4270	0.7184	0.9567	0.9942	0.9984	(94)
Useful gains	785.3285	940.4418	1070.6395	1174.6195	1067.2523	754.6366	499.1178	523.4005	785.3459	869.2465	784.1469	745.0492	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.5719	1991.9565	1805.2689	1504.5682	1153.0991	763.6230	499.9302	525.1711	829.7765	1264.6724	1684.0577	2040.4538	(97)
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98a)
Space heating requirement - total per year (kWh/year)												4404.8460	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	944.3171	706.6179	546.5643	237.5630	63.8700	0.0000	0.0000	0.0000	0.0000	294.1968	647.9358	963.7810	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4404.8460	
Space heating per m2											(98c) / (4) =	27.5941	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1243.4642	978.8974	1002.8819	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9294	0.9684	0.9486	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1155.6593	947.9766	951.3502	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	265.3394	378.3478	282.1746	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	66.3349	94.5870	70.5437	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												231.4655	(107)
Energy for space heating												27.5941	(99)
Energy for space cooling												1.4500	(108)
Total												29.0441	(109)
Fabric Energy Efficiency (DFEE)												29.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
										Total per year (kWh/year) = Sum(64)m =		991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)

Opening Type 3			1.2500	1.1450	1.4313		(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000 (28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000 (29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000 (30)
Total net area of external elements Aum(A, m2)			232.3500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688		(33)
Main dwelling							
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000 (32)
Internal Wall 1			112.0000			9.0000	1008.0000 (32c)
Internal Ceiling 1			60.6500			9.0000	545.8500 (32e)
Internal Ceiling 2			60.6500			9.0000	545.8500 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2											(98c) / (4) =	25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8314.7544	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			449.9735	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7916	(257)
SAP value		87.1677	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1717.3461	(272)
CO2 emissions per m2			10.7600	(273)
EI value			88.7541	
EI rating			89	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7376.6042	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			665.3087	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1520.3346	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8507.5952	(286)

SAP 10 EPC IMPROVEMENTS

Baseline

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 89

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (7.8%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	B 91	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£553	£553	£0
Space heating	£380	£380	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£665	£435	£230
Total cost of uses	£666	£436	£230
Delivered energy	46 kWh/m²	41 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.4 tonnes	0.1 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	1 kg/m²
Primary energy	53 kWh/m²	45 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3741 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4412	0.4326	0.4239	0.3806	0.3720	0.3287	0.3287	0.3201	0.3460	0.3720	0.3893	0.4066	(22b)
Effective ac	0.5973	0.5936	0.5898	0.5724	0.5692	0.5540	0.5540	0.5512	0.5599	0.5692	0.5758	0.5827	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	79.4207	78.9182	78.4256	76.1121	75.6792	73.6642	73.6642	73.2911	74.4404	75.6792	76.5549	77.4704	(38)
Heat transfer coeff	138.9616	138.4591	137.9665	135.6530	135.2201	133.2051	133.2051	132.8320	133.9813	135.2201	136.0958	137.0112	(39)
Average = Sum(39)m / 12 =												135.6509	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8705	0.8674	0.8643	0.8498	0.8471	0.8345	0.8345	0.8321	0.8393	0.8471	0.8526	0.8583	(40)
HLP (average)												0.8498	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0607	72.3222	72.5804	73.8183	74.0546	75.1748	75.1748	75.3860	74.7393	74.0546	73.5781	73.0865	
alpha	5.8040	5.8215	5.8387	5.9212	5.9370	6.0117	6.0117	6.0257	5.9826	5.9370	5.9052	5.8724	
util living area	0.9971	0.9929	0.9780	0.9200	0.7807	0.5797	0.4234	0.4771	0.7498	0.9585	0.9936	0.9978	(86)
MIT	20.1414	20.2687	20.4770	20.7281	20.8850	20.9396	20.9472	20.9462	20.9115	20.6862	20.3675	20.1237	(87)
Th 2	20.1926	20.1953	20.1980	20.2104	20.2127	20.2236	20.2236	20.2256	20.2194	20.2127	20.2080	20.2031	(88)
util rest of house	0.9962	0.9909	0.9716	0.8986	0.7336	0.5137	0.3495	0.3983	0.6836	0.9427	0.9914	0.9972	(89)
MIT 2	19.1733	19.3379	19.6032	19.9192	20.0926	20.1521	20.1569	20.1586	20.1271	19.8775	19.4751	19.1593	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3633	19.5206	19.7747	20.0780	20.2481	20.3066	20.3120	20.3132	20.2811	20.0362	19.6502	19.3486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9887	0.9675	0.8945	0.7358	0.5209	0.3579	0.4073	0.6892	0.9384	0.9893	0.9962	(94)
Useful gains	923.6682	1050.7635	1174.7001	1227.6727	1083.2319	752.4799	493.7915	518.3951	791.8516	935.3015	886.8844	877.2692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2093.2245	2024.3572	1831.4605	1516.3281	1155.8812	760.1520	494.4565	519.7925	828.1475	1275.9696	1708.0350	2075.5232	(97)
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98a)
Space heating requirement - total per year (kWh/year)												4011.1042	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4011.1042	
Space heating per m2										(98c) / (4) =		25.1275	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	870.1499	654.2550	488.6297	207.8319	54.0511	0.0000	0.0000	0.0000	0.0000	253.4571	591.2285	891.5010	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1039.6056	781.6666	583.7870	248.3058	64.5772	0.0000	0.0000	0.0000	0.0000	302.8161	706.3661	1065.1146	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5789	88.5636	88.5266	88.4400	88.3000	88.2000	88.2000	88.2000	88.2000	88.4640	88.5539	88.5822	(217)
Fuel for water heating, kWh/month	312.1549	275.5295	291.4341	253.1964	243.5787	217.2877	212.6934	222.5219	226.4890	254.7174	274.1259	308.3085	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1	4792.2391	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.0372	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7461.5747	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4792.2391	3.6400	174.4375	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.0372	3.6400	112.5502	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			309.2842	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5441 (257)
SAP value		91.1799
SAP rating (Section 12)		91 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4792.2391	0.2100	1006.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.0372	0.2100	649.3278	(264)
Space and water heating			1655.6980	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1603.2543	(272)
CO2 emissions per m2			10.0400	(273)
EI value			89.5012	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3741	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3460	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3633	0.3460	0.3460	0.3201	0.3201	0.2855	0.2941	0.2768	0.2855	0.3028	0.3028	0.3287	(22b)
Effective ac	0.5660	0.5599	0.5599	0.5512	0.5512	0.5408	0.5433	0.5383	0.5408	0.5458	0.5458	0.5540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.1450	19.5802			(27)
Opening Type 2			1.8900	1.2000	2.2680			(26)
Opening Type 3			1.2500	1.1450	1.4313			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.2688			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	59.5409 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	75.2563	74.4404	74.4404	73.2911	73.2911	71.8980	72.2313	71.5746	71.8980	72.5746	72.5746	73.6642	(38)
Heat transfer coeff	134.7972	133.9813	133.9813	132.8320	132.8320	131.4389	131.7722	131.1155	131.4389	132.1155	132.1155	133.2051	(39)
Average = Sum(39)m / 12 =												132.6354	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8444	0.8393	0.8393	0.8321	0.8321	0.8234	0.8255	0.8214	0.8234	0.8276	0.8276	0.8345	(40)
HLP (average)												0.8309	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)											141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	74.2869	74.7393	74.7393	75.3860	75.3860	76.1850	75.9923	76.3729	76.1850	75.7948	75.7948	75.1748	
alpha	5.9525	5.9826	5.9826	6.0257	6.0257	6.0790	6.0662	6.0915	6.0790	6.0530	6.0530	6.0117	
util living area													
	0.9956	0.9905	0.9684	0.8800	0.6883	0.4338	0.2851	0.3140	0.6212	0.9259	0.9889	0.9967	(86)
MIT	20.2518	20.3643	20.5743	20.8054	20.9221	20.9475	20.9487	20.9489	20.9381	20.7790	20.4818	20.2358	(87)
Th 2	20.2150	20.2194	20.2194	20.2256	20.2256	20.2331	20.2313	20.2348	20.2331	20.2294	20.2294	20.2236	(88)
util rest of house													
	0.9943	0.9877	0.9592	0.8499	0.6316	0.3681	0.2145	0.2391	0.5457	0.8991	0.9850	0.9957	(89)
MIT 2	19.3328	19.4793	19.7428	20.0214	20.1399	20.1670	20.1656	20.1694	20.1615	20.0014	19.6379	19.3194	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5132	19.6530	19.9060	20.1753	20.2934	20.3202	20.3193	20.3224	20.3139	20.1540	19.8035	19.4993	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9851	0.9547	0.8478	0.6368	0.3756	0.2226	0.2477	0.5539	0.8960	0.9822	0.9945	(94)
Useful gains	941.1673	1052.5189	1162.0734	1183.6053	941.1947	566.9060	318.7705	330.6749	663.1992	919.7545	909.5833	890.5585	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1942.8588	1882.8420	1675.5685	1364.8848	968.7982	567.8364	318.7978	330.7254	672.1641	1130.1135	1559.4297	1918.0562	(97)
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98a)
Space heating requirement - total per year (kWh/year)												3225.1890	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3225.1890	
Space heating per m2											(98c) / (4) =	20.2042	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	745.2585	557.9771	382.0404	130.5212	20.5370	0.0000	0.0000	0.0000	0.0000	156.5071	467.8894	764.4582	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	890.3925	666.6393	456.4401	155.9393	24.5364	0.0000	0.0000	0.0000	0.0000	186.9858	559.0077	913.3312	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5641	88.5473	88.4978	88.3835	88.2434	88.2000	88.2000	88.2000	88.2000	88.4043	88.5286	88.5678	(217)
Fuel for water heating, kWh/month													
	312.2069	275.5804	291.5290	253.3583	243.7350	217.2877	212.6934	222.5219	226.4890	254.8894	274.2043	308.3587	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3853.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.8538	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6491.3947	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3853.2724	6.3400	244.2975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	6.3400	196.0869	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			435.1542	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3853.2724	0.2100	809.1872	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.8538	0.2100	649.4993	(264)
Space and water heating			1458.6865	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1401.9326	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3853.2724	1.1300	4354.1978	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.8538	1.1300	3494.9248	(278)
Space and water heating			7849.1226	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			7184.8454	(286)

Full SAP Calculation Printout

Plot Reference	Plot 6	**Issued on Date**	05/11/2026
Assessment Reference	Lean	**Plot Type Ref**	
Plot Address		**SAP Version**	10.2

SAP Rating	88 B	**DER**	10.34	**TER**	8.30
Environmental	90 B	**% DER < TER**			-24.58
CO_2 Emissions (t/year)	1.43	**DFEE**	26.25	**TFEE**	31.36
Compliance Check	See BREL	**% DFEE < TFEE**			16.30
% DPER < TPER	-33.43	**DPER**	57.71	**TPER**	43.25

Assessor Details	Mr. Neil Vanson	**Assessor ID**	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)

Average = Sum(39)m / 12 = 127.7343

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 83.7000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year
Space heating fuel - main system 1 4477.1386 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 88.2000
Water heating fuel used 3092.2959 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
central heating pump 41.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 86.0000 (231)
Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7999.9125	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1651.2293	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.3400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			9211.9336	(286)
Dwelling Primary energy Rate (DPER)			57.7100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)

TER Roof Light			1.2500	1.5918	2.3148	(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340	(30)
Total net area of external elements Aum(A, m2)			232.3500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743	(33)
Main dwelling						
Party Wall 1			51.4000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
									Total per year (kWh/year) = Sum(64)m =			2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East				11.3400	19.6403	0.6300	0.7000	0.7700				68.0663	(76)
West				5.7600	19.6403	0.6300	0.7000	0.7700				34.5734	(80)
North				0.2500	15.2954	0.6300	0.7000	1.0000				1.5177	(82)
South				1.0000	47.0123	0.6300	0.7000	1.0000				18.6592	(82)
Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4813.0912	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)

Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2768 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)
Effective ac 0.5623 0.5599 0.5575 0.5464 0.5443 0.5346 0.5346 0.5328 0.5383 0.5443 0.5485 0.5529 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			670.9515	(64a)
Heat gains from water heating, kWh/month	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)

Total internal gains

	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												253.5180	(107)
Energy for space heating												24.6606	(99)
Energy for space cooling												1.5882	(108)
Total												26.2487	(109)
Fabric Energy Efficiency (DFEE)												26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450	
E3 Sill	12.0000	0.0500	0.6000	
E4 Jamb	25.2000	0.0500	1.2600	
E5 Ground floor (normal)	22.2100	0.1600	3.5536	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.3586 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)

Hot water usage for baths

	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896 (42b)

Hot water usage for other uses

	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244 (42c)

Average daily hot water use (litres/day) 70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)

Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	7749.5719	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Total energy cost			429.4008	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7554	(257)
SAP value		87.7544	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1598.6578	(272)
CO2 emissions per m2			10.0100	(273)
EI value			89.5313	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
									Total per year (kWh/year) = Sum(64)m =			2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6929.2104	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Total energy cost			636.9439	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Total CO2, kg/year			1426.3819	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Total Primary energy kWh/year			8002.0403	(286)

SAP 10 EPC IMPROVEMENTS

Lean

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 90

N Solar water heating — SAP increase too small
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.0	-£ 230	-118 kg (8.3%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 29	-152 kg (10.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£230	0.74 kg/m²	A 92	B 90
Total Savings	£230	0.74 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£230	£230
Total cost of fuels	£637	£407	£230
Total cost of uses	£637	£407	£230
Delivered energy	43 kWh/m²	38 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.3 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	50 kWh/m²	42 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b) - (3b)	
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c) - (3c)	
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2										(98c) / (4) =		22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6525	-52.4628	-78.7446	-92.4542	-102.9041	-97.1294	-95.8356	-88.8408	-77.0378	-61.6245	-39.9345	-30.5588	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-853.1796	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6896.3923	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	16.4900	-140.6893	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-140.6893	(252)
Total energy cost			288.7115	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5079	(257)
SAP value		91.7666	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-853.1796	0.1337	-114.0918	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-114.0918	(269)
Total CO2, kg/year			1484.5660	(272)
CO2 emissions per m2			9.3000	(273)
EI value			90.2785	
EI rating			90	(274)
EI band			B	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	54.0265	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484	(42)
Hot water usage for mixer showers	73.6546 72.5477 70.9347 67.8487 65.5712 63.0314 61.5878 63.1885 64.9432 67.6702 70.8226	73.3724	(42a)
Hot water usage for baths	33.4706 32.9735 32.2735 30.9829 30.0164 28.9448 28.3660 29.0611 29.8179 30.9646 32.2818	33.3575	(42b)
Hot water usage for other uses	47.1836 45.4678 43.7521 42.0363 40.3205 38.6048 38.6048 40.3205 42.0363 43.7521 45.4678	47.1836	(42c)
Average daily hot water use (litres/day)		141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	83.7000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.1581	-52.8488	-78.6575	-94.1716	-103.1339	-101.0333	-99.0964	-93.1902	-80.9917	-65.0372	-44.5564	-33.3344	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-885.2095	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	6044.0010	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	26.0000	-230.1545	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-230.1545	(252)
Total energy cost			406.7894	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	0.1338	-118.4020	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-118.4020	(269)
Total CO2, kg/year			1307.9799	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-885.2095	1.4943	-1322.7498	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1322.7498	(283)
Total Primary energy kWh/year			6679.2905	(286)

Full SAP Calculation Printout

Plot Reference	Plot 6	Issued on Date	05/11/2026
Assessment Reference	Green	Plot Type Ref	
Plot Address		SAP Version	10.2

SAP Rating	97 A	DER	7.55	TER	8.30
Environmental	92 A	% DER < TER			9.04
CO_2 Emissions (t/year)	0.96	DFEE	26.25	TFEE	31.36
Compliance Check	See BREL	% DFEE < TFEE			16.30
% DPER < TPER	8.82	DPER	39.43	TPER	43.25

Assessor Details	Mr. Neil Vanson	Assessor ID	M057-0001
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		36049.2000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							225.8297	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
12Total per year (kWh/year)												2734	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains	707.4536	728.0243	693.9641	669.8714	633.1214	606.8689	581.3936	581.8350	601.2386	624.8928	665.7527	691.3392	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	855.6133	1013.8207	1157.6349	1339.7365	1451.3625	1443.9759	1378.5164	1267.8474	1138.0260	961.9023	849.6925	813.7289	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area	0.9980	0.9939	0.9798	0.9151	0.7615	0.5517	0.4011	0.4540	0.7274	0.9588	0.9947	0.9985	(86)
MIT	20.1782	20.3170	20.5153	20.7629	20.9035	20.9454	20.9501	20.9495	20.9242	20.7142	20.4026	20.1598	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house	0.9974	0.9922	0.9740	0.8933	0.7152	0.4908	0.3343	0.3824	0.6633	0.9435	0.9929	0.9981	(89)
MIT 2	19.2590	19.4378	19.6902	19.9987	20.1519	20.1967	20.1997	20.2010	20.1782	19.9485	19.5557	19.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4394	19.6103	19.8521	20.1487	20.2995	20.3436	20.3470	20.3479	20.3246	20.0988	19.7219	19.4221	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9903	0.9703	0.8899	0.7181	0.4976	0.3419	0.3905	0.6692	0.9396	0.9912	0.9974	(94)
Useful gains	852.6938	1003.9874	1123.2963	1192.1811	1042.2156	718.4677	471.3763	495.1265	761.5212	903.7890	842.2046	811.6532	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.4447	1910.0171	1728.7325	1436.8589	1095.6649	723.1163	471.7367	495.9326	787.2944	1210.2466	1616.4639	1959.9226	(97)
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98a)
Space heating requirement - total per year (kWh/year)												3747.3650	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3747.3650	
Space heating per m2											(98c) / (4) =	23.4753	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	832.3507	608.8519	450.4445	176.1680	39.7663	0.0000	0.0000	0.0000	0.0000	228.0044	557.4667	854.3125	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	994.4453	727.4217	538.1654	210.4755	47.5105	0.0000	0.0000	0.0000	0.0000	272.4067	666.0295	1020.6839	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5748	88.5564	88.5173	88.4195	88.2776	88.2000	88.2000	88.2000	88.2000	88.4508	88.5477	88.5784	(217)
Fuel for water heating, kWh/month	312.1694	275.5521	291.4648	253.2551	243.6403	217.2877	212.6934	222.5219	226.4890	254.7554	274.1449	308.3220	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4477.1386 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 88.2000

Water heating fuel used 3092.2959 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 344.4780 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -3454.4788 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4545.4337	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4477.1386	0.2100	940.1991	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.2959	0.2100	649.3821	(264)
Space and water heating			1589.5812	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1205.2802	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.5500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4477.1386	1.1300	5059.1666	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.2959	1.1300	3494.2944	(278)
Space and water heating			8553.4610	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	1.4985	-1911.9450	
PV Unit electricity exported	-2178.5650	0.4614	-1005.2333	
Total			-2917.1783	(283)
Total Primary energy kWh/year			6294.7553	(286)
Dwelling Primary energy Rate (DPER)			39.4300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		402.9080	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3493 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3586 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 63.1329 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)
Average = Sum(39)m / 12 =												138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day) 138.1375 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.2761	147.0670	143.1591	137.2169	132.3913	127.2035	125.2100	129.1010	133.2047	138.6510	144.6848	149.8864	(44)
Energy conte	238.0006	209.4215	220.0302	187.8430	178.2242	156.4115	151.4306	159.8541	164.2548	188.1481	206.1300	234.6859	(45)
Energy content (annual)										Total = Sum(45)m =		2294.4344	
Distribution loss (46)m = 0.15 x (45)m	35.7001	31.4132	33.0045	28.1765	26.7336	23.4617	22.7146	23.9781	24.6382	28.2222	30.9195	35.2029	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	288.9595	255.4489	270.9891	237.1581	229.1831	205.7266	202.3895	210.8130	213.5698	239.1070	255.4451	285.6448	(62)
WWHRS	-33.6718	-29.7796	-31.1835	-25.8212	-24.0644	-20.5921	-19.3018	-20.5255	-21.3054	-25.1167	-28.4541	-33.0482	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
										Total per year (kWh/year) = Sum(64)m =		2581.5702	(64)
12Total per year (kWh/year)												2582	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	91.8749	81.1395	85.8998	74.7866	71.9993	64.3356	63.0904	65.8912	66.9435	75.2990	80.8670	90.7728	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)	123.4878	120.7433	115.4567	103.8702	96.7732	89.3550	84.7989	88.5634	92.9770	101.2083	112.3153	122.0064	(72)
Total internal gains	710.9309	731.5909	697.6820	673.8929	637.3353	611.2816	585.9157	586.2473	605.5250	628.9590	669.5264	694.8531	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	833.7475	968.5010	1082.0407	1229.1758	1315.6142	1305.1992	1246.6885	1154.9155	1050.4934	908.3221	822.0028	796.3077	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area	0.9983	0.9956	0.9874	0.9497	0.8420	0.6448	0.4763	0.5334	0.8045	0.9733	0.9959	0.9987	(86)
MIT	19.8328	20.0038	20.2608	20.6128	20.8673	20.9784	20.9969	20.9942	20.9251	20.5781	20.1490	19.8129	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house	0.9978	0.9943	0.9836	0.9343	0.7995	0.5736	0.3924	0.4452	0.7409	0.9622	0.9945	0.9983	(89)
MIT 2	18.7977	19.0180	19.3465	19.7916	20.0831	20.1958	20.2080	20.2085	20.1507	19.7574	19.2125	18.7789	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0008	19.2115	19.5260	19.9527	20.2370	20.3494	20.3628	20.3627	20.3027	19.9184	19.3963	18.9818	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9794	0.9286	0.8017	0.5866	0.4089	0.4624	0.7494	0.9572	0.9925	0.9975	(94)
Useful gains	831.0524	960.9267	1059.7293	1141.4391	1054.7093	765.6787	509.7222	534.0509	787.2694	869.4473	815.8234	794.3138	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2071.2515	2010.1244	1823.9736	1525.3796	1174.9597	781.2015	511.2758	537.1465	846.9881	1282.5151	1701.7554	2057.5295	(97)
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98a)
Space heating requirement - total per year (kWh/year)												4447.2962	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4447.2962	
Space heating per m2											(98c) / (4) =	27.8600	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.4000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.7081	705.0608	568.5978	276.4372	89.4663	0.0000	0.0000	0.0000	0.0000	307.3224	637.8710	939.8325	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	998.6019	763.0529	615.3656	299.1745	96.8250	0.0000	0.0000	0.0000	0.0000	332.6000	690.3366	1017.1347	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.2877	225.6692	239.8056	211.3369	205.1187	185.1345	183.0877	190.2874	192.2645	213.9904	226.9909	252.5965	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.8835	86.6499	86.1626	84.9578	82.7306	80.3000	80.3000	80.3000	80.3000	85.1563	86.4694	86.9279	(217)
Fuel for water heating, kWh/month	293.8277	260.4379	278.3174	248.7553	247.9357	230.5536	228.0046	236.9707	239.4327	251.2912	262.5100	290.5818	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	38.7306	31.0712	27.9761	20.4965	15.8321	12.9350	14.4426	18.7730	24.3843	31.9935	36.1366	39.8071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.1940	-78.9210	-112.9493	-126.3343	-135.5486	-126.1442	-124.4852	-117.8228	-106.0134	-89.8616	-61.6349	-48.6100	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-32.6096	-68.5219	-136.1032	-204.3313	-270.1602	-271.5580	-268.4594	-227.3837	-166.7045	-98.0731	-43.5538	-25.8003	(233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4813.0912	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	3068.6186	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	312.5785	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2997.7782	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5282.5101	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4813.0912	0.2100	1010.7491	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3068.6186	0.2100	644.4099	(264)
Space and water heating			1655.1591	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	312.5785	0.1443	45.1147	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	0.1347	-159.5629	
PV Unit electricity exported	-1813.2588	0.1259	-228.2870	
Total			-387.8498	(269)
Total CO2, kg/year			1324.3532	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4813.0912	1.1300	5438.7930	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3068.6186	1.1300	3467.5390	(278)
Space and water heating			8906.3320	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	312.5785	1.5338	479.4433	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1184.5194	1.4979	-1774.2453	
PV Unit electricity exported	-1813.2588	0.4621	-837.9686	
Total			-2612.2138	(283)
Total Primary energy kWh/year			6903.6624	(286)
Target Primary Energy Rate (TPER)			43.2500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2993	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2768	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3530	0.3460	0.3391	0.3045	0.2976	0.2630	0.2630	0.2561	0.2768	0.2976	0.3114	0.3253	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	74.7620	74.4404	74.1251	72.6445	72.3675	71.0778	71.0778	70.8390	71.5746	72.3675	72.9279	73.5138	(38)
Heat transfer coeff													
	128.7885	128.4669	128.1517	126.6710	126.3940	125.1044	125.1044	124.8655	125.6011	126.3940	126.9544	127.5403	(39)
Average = Sum(39)m / 12 =												126.6697	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8068	0.8048	0.8028	0.7935	0.7918	0.7837	0.7837	0.7822	0.7868	0.7918	0.7953	0.7990	(40)
HLP (average)												0.7935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)

Hot water usage for other uses

44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)

Average daily hot water use (litres/day)	70.2304 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss (or HIU loss):

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
								Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)											991	(64)
Electric shower(s)												

	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	787.0827	946.7517	1093.8855	1283.9306	1400.2433	1400.8018	1338.6963	1225.7544	1093.1940	908.5551	788.7606	746.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7528	77.9474	78.1392	79.0526	79.2258	80.0425	80.0425	80.1956	79.7259	79.2258	78.8761	78.5138	
alpha	6.1835	6.1965	6.2093	6.2702	6.2817	6.3362	6.3362	6.3464	6.3151	6.2817	6.2584	6.2343	
util living area													
	0.9987	0.9957	0.9843	0.9262	0.7771	0.5644	0.4103	0.4666	0.7464	0.9674	0.9964	0.9991	(86)
MIT	19.9357	20.1218	20.3900	20.7313	20.9317	20.9921	20.9991	20.9980	20.9603	20.6593	20.2348	19.9086	(87)
Th 2	20.2474	20.2492	20.2509	20.2589	20.2605	20.2675	20.2675	20.2688	20.2648	20.2605	20.2574	20.2542	(88)
util rest of house													
	0.9984	0.9945	0.9797	0.9064	0.7317	0.5028	0.3425	0.3935	0.6829	0.9548	0.9952	0.9988	(89)
MIT 2	19.2585	19.4453	19.7119	20.0438	20.2155	20.2638	20.2672	20.2681	20.2430	19.9838	19.5652	19.2370	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3914	19.5780	19.8450	20.1787	20.3561	20.4067	20.4108	20.4114	20.3838	20.1164	19.6966	19.3688	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9930	0.9766	0.9040	0.7379	0.5147	0.3558	0.4078	0.6937	0.9518	0.9939	0.9984	(94)
Useful gains	785.3302	940.1094	1068.2786	1160.6523	1033.1999	720.9464	476.3107	499.8728	758.3536	864.7251	783.9379	745.0649	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1943.6001	1885.6434	1710.1858	1428.6884	1094.0737	726.4460	476.7535	500.8858	789.2475	1202.8159	1599.1935	1934.6341	(97)
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98a)
Space heating requirement - total per year (kWh/year)												3936.5697	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	861.7528	635.3989	477.5790	192.9860	45.2901	0.0000	0.0000	0.0000	0.0000	251.5395	586.9840	885.0395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3936.5697	
Space heating per m2											(98c) / (4) =	24.6606	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1175.9810	925.7723	948.9781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9481	0.9786	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1114.9344	905.9582	914.2177	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1524.1863	1456.5087	1330.6171	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	294.6613	409.6096	309.8012	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	73.6653	102.4024	77.4503	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement	253.5180	(107)
Energy for space heating	24.6606	(99)
Energy for space cooling	1.5882	(108)
Total	26.2487	(109)
Fabric Energy Efficiency (DFEE)	26.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0993	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3493	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3231	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4119	0.4039	0.3958	0.3554	0.3473	0.3069	0.3069	0.2989	0.3231	0.3473	0.3635	0.3796	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5848	0.5815	0.5783	0.5632	0.5603	0.5471	0.5471	0.5447	0.5522	0.5603	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type			17.1000	1.1450	19.5802			(27)
TER Roof Light			1.2500	1.5918	2.3148			(27a)
Heatloss Floor 1			60.6500	0.1300	7.8845			(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1800	16.5708			(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1100	6.5340			(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7743			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	225.8297	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	25.2000	0.0500	1.2600
E5 Ground floor (normal)	22.2100	0.1600	3.5536
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000
R11 Upstands or kerbs of rooflights	10.0000	0.0800	0.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.3586	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	63.1329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.7605	77.3225	76.8931	74.8764	74.4991	72.7425	72.7425	72.4173	73.4191	74.4991	75.2624	76.0604	(38)
Heat transfer coeff	140.8934	140.4554	140.0260	138.0093	137.6319	135.8754	135.8754	135.5501	136.5520	137.6319	138.3953	139.1933	(39)

Average = Sum(39)m / 12 =	138.0074	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8826	0.8799	0.8772	0.8646	0.8622	0.8512	0.8512	0.8492	0.8554	0.8622	0.8670	0.8720	(40)
HLP (average)												0.8645	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	31.7971	31.3249	30.6599	29.4337	28.5156	27.4976	26.9477	27.6080	28.3270	29.4164	30.6677	31.6896	(42b)
Hot water usage for other uses													
	44.8244	43.1944	41.5645	39.9345	38.3045	36.6745	36.6745	38.3045	39.9345	41.5645	43.1944	44.8244	(42c)
Average daily hot water use (litres/day)												70.2304	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	76.6215	74.5193	72.2243	69.3682	66.8201	64.1721	63.6222	65.9125	68.2615	70.9808	73.8622	76.5140	(44)
Energy conte	121.3498	106.1145	111.0061	94.9616	89.9527	78.9071	76.9455	81.6135	84.1732	96.3203	105.2302	119.8025	(45)
Energy content (annual)										Total = Sum(45)m =		1166.3770	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	103.1473	90.1973	94.3552	80.7174	76.4598	67.0710	65.4037	69.3714	71.5473	81.8723	89.4457	101.8321	(64)
									Total per year (kWh/year) = Sum(64)m =			991.4204	(64)
12Total per year (kWh/year)												991	(64)
Electric shower(s)													
	58.9850	52.5562	57.3893	54.7659	55.7936	53.2217	54.9957	55.7936	54.7659	57.3893	56.3102	58.9850	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						670.9515	(64a)
Heat gains from water heating, kWh/month													
	40.5331	35.6884	37.9361	33.8708	33.0633	30.0732	30.0999	31.2913	31.5783	34.8154	36.4390	40.2043	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	147.4193	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	186.4020	206.3736	186.4020	192.6154	186.4020	192.6154	186.4020	186.4020	192.6154	186.4020	192.6154	186.4020	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	330.8154	334.2482	325.5976	307.1815	283.9344	262.0854	247.4890	244.0561	252.7068	271.1229	294.3700	316.2189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	37.7419	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	54.4800	53.1077	50.9894	47.0428	44.4400	41.7683	40.4568	42.0581	43.8587	46.7949	50.6097	54.0380	(72)
Total internal gains													
	638.9231	660.9553	630.2148	614.0654	582.0021	563.6949	541.5735	539.7420	556.4067	571.5455	604.8208	623.8847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.6300	0.7000	0.7700	68.0663	(76)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
North	0.2500	15.2954	0.6300	0.7000	1.0000	1.5177	(82)
South	1.0000	47.0123	0.6300	0.7000	1.0000	18.6592	(82)

Solar gains	122.8165	236.9101	384.3586	555.2830	678.2788	693.9176	660.7728	568.6682	444.9685	279.3632	152.4764	101.4546	(83)
Total gains	761.7396	897.8654	1014.5734	1169.3484	1260.2810	1257.6124	1202.3463	1108.4102	1001.3751	850.9087	757.2972	725.3393	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.0726	71.2943	71.5129	72.5579	72.7569	73.6974	73.6974	73.8743	73.3323	72.7569	72.3556	71.9407	
alpha	5.7382	5.7530	5.7675	5.8372	5.8505	5.9132	5.9132	5.9250	5.8888	5.8505	5.8237	5.7960	
util living area													
	0.9990	0.9970	0.9908	0.9590	0.8606	0.6654	0.4932	0.5542	0.8276	0.9801	0.9973	0.9992	(86)
MIT	19.7780	19.9508	20.2122	20.5773	20.8494	20.9746	20.9962	20.9929	20.9124	20.5395	20.1002	19.7586	(87)
Th 2	20.1823	20.1846	20.1869	20.1977	20.1998	20.2092	20.2092	20.2109	20.2056	20.1998	20.1957	20.1914	(88)
util rest of house													
	0.9986	0.9961	0.9878	0.9458	0.8204	0.5933	0.4067	0.4633	0.7665	0.9715	0.9964	0.9990	(89)
MIT 2	19.0486	19.2228	19.4843	19.8485	20.0950	20.1968	20.2081	20.2086	20.1545	19.8185	19.3810	19.0365	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1917	19.3656	19.6272	19.9916	20.2431	20.3495	20.3628	20.3625	20.3032	19.9600	19.5222	19.1782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9949	0.9852	0.9417	0.8228	0.6065	0.4237	0.4812	0.7748	0.9681	0.9953	0.9986	(94)
Useful gains	760.2895	893.2809	999.5462	1101.2211	1036.9722	762.8046	509.3904	533.3123	775.8614	823.8022	753.7068	724.2982	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2098.1475	2031.7764	1838.1478	1530.7397	1175.7970	781.2097	511.2666	537.1227	847.0617	1288.2342	1719.1722	2084.8644	(97)
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98a)
Space heating requirement - total per year (kWh/year)												4849.8276	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	995.3664	765.0690	623.9195	309.2534	103.2856	0.0000	0.0000	0.0000	0.0000	345.5374	695.1351	1012.2613	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4849.8276	
Space heating per m2											(98c) / (4) =	30.3817	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1277.2289	1005.4781	1030.1810	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8808	0.9403	0.9111	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1124.9236	945.4638	938.6280	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1359.9193	1300.0920	1196.0359	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	169.1969	263.8433	191.5115	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.2992	65.9608	47.8779	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												156.1379	(107)
Energy for space heating												30.3817	(99)
Energy for space cooling												0.9781	(108)
Total												31.3598	(109)
Fabric Energy Efficiency (TFEE)												31.4	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	402.9080	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9484 (42)

Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)		141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)
Total internal gains												
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897 (83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction									fLA = Living area / (4) =			0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 83.7000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734	(217)
Fuel for water heating, kWh/month													
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4226.6405	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3092.4534	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3454.4788	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4295.0931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710	(257)
SAP value		97.2275	
SAP rating (Section 12)		97	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)
Total CO2, kg/year			1152.7087	(272)
CO2 emissions per m2			7.2200	(273)
EI value			92.4516	
EI rating			92	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

Main dwelling	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.6500	(1b) x	2.4000	(2b) =	145.5600	(1b) - (3b)
First floor	60.6500	(1c) x	2.6000	(2c) =	157.6900	(1c) - (3c)
Second floor	38.3300	(1d) x	2.6000	(2d) =	99.6580	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 159.6300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 402.9080 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 225.8297 (35)
List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774	
E3 Sill	12.0000	0.0190	0.2280	
E4 Jamb	25.2000	0.0060	0.1512	
E5 Ground floor (normal)	22.2100	0.0930	2.0655	
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0350	0.3500	
E18 Party wall between dwellings	10.0000	0.0000	0.0000	
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2721 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9484 (42)
Hot water usage for mixer showers

73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day) 141.8338 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	

Distribution loss (46)m = 0.15 x (45)m

36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)

Water storage loss (or HIU loss):
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153 (61)

Total heat required for water heating calculated for each month

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)

Total per year (kWh/year) = Sum(64)m = 2733.9853 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354 (71)

Water heating gains (Table 5)

	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925 (72)

Total internal gains

	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)													
	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)													
	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month													
	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	

Total	-469.7486 (269)
Total CO2, kg/year	956.6333 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)

SAP 10 EPC IMPROVEMENTS

Green

Current energy efficiency rating: A 97
Current environmental impact rating: A 92

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Already installed
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 31	-152 kg (15.9%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 599 TEST (30 Sep 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£112	£112	£0
Mains gas	£525	£525	£0
Space heating	£351	£351	£0
Water heating	£196	£196	£0
Lighting	£90	£90	£0
Generated (PV)	-£477	-£477	£0
Total cost of fuels	£160	£160	£0
Total cost of uses	£160	£160	£0
Delivered energy	21 kWh/m²	21 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	31 kWh/m²	31 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600 (1b)	- (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900 (1c)	- (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)

Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	5 * 10 =	50.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3822	0.3747	0.3672	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)
Effective ac	0.5731	0.5702	0.5674	0.5544	0.5519	0.5406	0.5406	0.5384	0.5449	0.5519	0.5569	0.5620	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	76.1927	75.8155	75.4458	73.7094	73.3845	71.8721	71.8721	71.5920	72.4546	73.3845	74.0417	74.7288	(38)
Heat transfer coeff	130.2192	129.8420	129.4723	127.7359	127.4110	125.8986	125.8986	125.6186	126.4812	127.4110	128.0682	128.7553	(39)
Average = Sum(39)m / 12 =												127.7343	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8158	0.8134	0.8111	0.8002	0.7982	0.7887	0.7887	0.7869	0.7923	0.7982	0.8023	0.8066	(40)
HLP (average)												0.8002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9484	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)

Hot water usage for baths

33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)

Hot water usage for other uses

47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)

Average daily hot water use (litres/day)	141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)

FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
											Total per year (kWh/year) = Sum(64)m =	2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	19.6403	0.7600	0.7000	0.7700	82.1117	(76)
West	5.7600	19.6403	0.7600	0.7000	0.7700	41.7075	(80)
North	0.2500	15.2954	0.7600	0.7000	1.0000	1.8309	(82)
South	1.0000	47.0123	0.7600	0.7000	1.0000	22.5095	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	148.1596	285.7964	463.6707	669.8652	818.2411	837.1069	797.1228	686.0124	536.7874	337.0095	183.9398	122.3897	(83)
Total gains	928.2953	1062.7695	1214.2063	1372.4668	1472.1231	1444.6568	1379.5767	1272.6692	1148.9836	996.7010	896.4608	880.5769	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.8986	77.1219	77.3421	78.3935	78.5934	79.5375	79.5375	79.7149	79.1712	78.5934	78.1901	77.7728	
alpha	6.1266	6.1415	6.1561	6.2262	6.2396	6.3025	6.3025	6.3143	6.2781	6.2396	6.2127	6.1849	
util living area													
	0.9969	0.9922	0.9747	0.9072	0.7537	0.5514	0.4008	0.4523	0.7220	0.9520	0.9930	0.9977	(86)
MIT	20.2200	20.3443	20.5441	20.7741	20.9061	20.9454	20.9501	20.9495	20.9252	20.7297	20.4289	20.1984	(87)
Th 2	20.2397	20.2417	20.2437	20.2532	20.2549	20.2631	20.2631	20.2647	20.2600	20.2549	20.2514	20.2476	(88)
util rest of house													
	0.9960	0.9900	0.9677	0.8842	0.7072	0.4906	0.3341	0.3809	0.6578	0.9347	0.9906	0.9971	(89)
MIT 2	19.3123	19.4725	19.7258	20.0112	20.1543	20.1967	20.1997	20.2010	20.1790	19.9666	19.5890	19.2913	(90)
Living area fraction											fLA = Living area / (4) =	0.1963	(91)
MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4905	19.6436	19.8864	20.1610	20.3018	20.3436	20.3470	20.3479	20.3254	20.1164	19.7539	19.4693	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9878	0.9637	0.8810	0.7103	0.4973	0.3417	0.3891	0.6638	0.9309	0.9886	0.9961	(94)
Useful gains	923.4915	1049.8409	1170.0894	1209.1308	1045.5898	718.4804	471.3780	495.1455	762.7165	927.8079	886.1974	877.1826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1978.0918	1914.3357	1733.1636	1438.4306	1095.9659	723.1174	471.7368	495.9344	787.4010	1212.4915	1620.5580	1966.0103	(97)
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98a)
Space heating requirement - total per year (kWh/year)												3537.6981	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.6981	
Space heating per m2											(98c) / (4) =	22.1619	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.6226	580.9405	418.9272	165.0959	37.4798	0.0000	0.0000	0.0000	0.0000	211.8046	528.7396	810.0878	(98)
Space heating efficiency (main heating system 1)													

	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000 (210)
Space heating fuel (main heating system)												
	937.4225	694.0747	500.5104	197.2472	44.7787	0.0000	0.0000	0.0000	0.0000	253.0521	631.7081	967.8469 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066 (64)
Efficiency of water heater												88.2000 (216)
(217)m	88.5692	88.5515	88.5088	88.4115	88.2738	88.2000	88.2000	88.2000	88.2000	88.4416	88.5421	88.5734 (217)
Fuel for water heating, kWh/month												
	312.1892	275.5672	291.4927	253.2779	243.6508	217.2877	212.6934	222.5219	226.4890	254.7819	274.1625	308.3393 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.7123	-86.0830	-122.4510	-135.9080	-144.7083	-134.2413	-132.4472	-125.9101	-114.0108	-97.5433	-67.4615	-53.4369 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-38.4607	-81.0769	-162.2415	-245.6361	-326.6572	-329.1861	-324.8559	-273.6379	-198.9154	-116.1484	-51.3582	-30.3908 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4226.6405 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	88.2000
Water heating fuel used	3092.4534 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	344.4780 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3454.4788 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4295.0931 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.6405	3.6400	153.8497	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3092.4534	3.6400	112.5653	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Energy for lighting	344.4780	16.4900	56.8044	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	16.4900	-210.3982	
PV Unit electricity exported	-2178.5650	5.5900	-121.7818	
Total			-332.1800	(252)
Total energy cost			97.2209	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.1710 (257)
SAP value		97.2275
SAP rating (Section 12)		97 (258)
SAP band		A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4226.6405	0.2100	887.5945	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3092.4534	0.2100	649.4152	(264)
Space and water heating			1537.0097	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1275.9138	0.1349	-172.0884	
PV Unit electricity exported	-2178.5650	0.1257	-273.8607	
Total			-445.9491	(269)

Total CO2, kg/year	1152.7087 (272)
CO2 emissions per m2	7.2200 (273)
EI value	92.4516
EI rating	92 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.6500 (1b)	x	2.4000 (2b)	=	145.5600	(1b) - (3b)
First floor	60.6500 (1c)	x	2.6000 (2c)	=	157.6900	(1c) - (3c)
Second floor	38.3300 (1d)	x	2.6000 (2d)	=	99.6580	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	159.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	402.9080	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	5 * 10 =	50.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1241	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3241	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.3148	0.2998	0.2998	0.2773	0.2773	0.2473	0.2548	0.2398	0.2473	0.2623	0.2623	0.2848	(22b)
Effective ac	0.5495	0.5449	0.5449	0.5384	0.5384	0.5306	0.5325	0.5288	0.5306	0.5344	0.5344	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			17.1000	1.0536	18.0172			(27)
Opening Type 2			1.8900	1.1000	2.0790			(26)
Opening Type 3			1.2500	1.0536	1.3170			(27a)
Heatloss Floor 1			60.6500	0.1100	6.6715	110.0000	6671.5000	(28a)
External Wall 1	111.0500	18.9900	92.0600	0.1600	14.7296	190.0000	17491.4000	(29a)
External Roof 1	60.6500	1.2500	59.4000	0.1000	5.9400	9.0000	534.6000	(30)
Total net area of external elements Aum(A, m2)			232.3500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7544			(33)
Main dwelling								
Party Wall 1			51.4000	0.0000	0.0000	180.0000	9252.0000	(32)
Internal Wall 1			112.0000			9.0000	1008.0000	(32c)
Internal Ceiling 1			60.6500			9.0000	545.8500	(32e)
Internal Ceiling 2			60.6500			9.0000	545.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	36049.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		225.8297 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0060	0.0774
E3 Sill	12.0000	0.0190	0.2280
E4 Jamb	25.2000	0.0060	0.1512
E5 Ground floor (normal)	22.2100	0.0930	2.0655
E6 Intermediate floor within a dwelling	22.2100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0350	0.3500
E18 Party wall between dwellings	10.0000	0.0000	0.0000
R11 Upstands or kerbs of rooflights	10.0000	0.2400	2.4000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.2721 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	54.0265 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.0671	72.4546	72.4546	71.5920	71.5920	70.5464	70.7966	70.3037	70.5464	71.0543	71.0543	71.8721	(38)
Heat transfer coeff	127.0936	126.4812	126.4812	125.6186	125.6186	124.5730	124.8232	124.3302	124.5730	125.0808	125.0808	125.8986	(39)
Average = Sum(39)m / 12 =												125.4711	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7962	0.7923	0.7923	0.7869	0.7869	0.7804	0.7820	0.7789	0.7804	0.7836	0.7836	0.7887	(40)
HLP (average)												0.7860	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9484	(42)
Hot water usage for mixer showers													
	73.6546	72.5477	70.9347	67.8487	65.5712	63.0314	61.5878	63.1885	64.9432	67.6702	70.8226	73.3724	(42a)
Hot water usage for baths													
	33.4706	32.9735	32.2735	30.9829	30.0164	28.9448	28.3660	29.0611	29.8179	30.9646	32.2818	33.3575	(42b)
Hot water usage for other uses													
	47.1836	45.4678	43.7521	42.0363	40.3205	38.6048	38.6048	40.3205	42.0363	43.7521	45.4678	47.1836	(42c)
Average daily hot water use (litres/day)												141.8338	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	154.3088	150.9891	146.9604	140.8678	135.9082	130.5810	128.5585	132.5701	136.7974	142.3869	148.5723	153.9135	(44)
Energy conte	244.3874	215.0064	225.8726	192.8410	182.9585	160.5645	155.4804	164.1495	168.6849	193.2176	211.6684	240.9913	(45)
Energy content (annual)										Total = Sum(45)m =		2355.8227	
Distribution loss (46)m = 0.15 x (45)m													
	36.6581	32.2510	33.8809	28.9262	27.4438	24.0847	23.3221	24.6224	25.3027	28.9826	31.7503	36.1487	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	32.1159	29.0124	32.1240	31.0858	32.1214	31.0832	32.1152	32.1148	31.0784	32.1155	31.0807	32.1153	(61)
Total heat required for water heating calculated for each month													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.9853	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	89.2878	78.7428	83.1336	71.8911	68.8641	61.1585	59.7260	62.6084	63.8573	72.2737	78.1499	88.1584	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	176.9031	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7644	43.3121	35.2238	26.6667	19.9337	16.8288	18.1841	23.6364	31.7248	40.2819	47.0149	50.1197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	493.7543	498.8779	485.9666	458.4798	423.7827	391.1723	369.3865	364.2629	377.1743	404.6610	439.3582	471.9686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	55.6387	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	-117.9354	(71)
Water heating gains (Table 5)													
	120.0105	117.1767	111.7388	99.8487	92.5592	84.9424	80.2769	84.1511	88.6907	97.1421	108.5416	118.4925	(72)
Total internal gains													
	780.1356	776.9732	750.5355	702.6016	653.8820	607.5499	582.4540	586.6568	612.1962	659.6915	712.5210	758.1872	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	11.3400	22.3313	0.7600	0.7000	0.7700	93.3624	(76)
West	5.7600	22.3313	0.7600	0.7000	0.7700	47.4222	(80)
North	0.2500	17.0613	0.7600	0.7000	1.0000	2.0422	(82)
South	1.0000	52.2757	0.7600	0.7000	1.0000	25.0296	(82)

Solar gains	167.8565	291.4302	466.6618	693.5195	824.1537	901.8355	849.6635	748.5735	585.2056	366.8611	213.5242	137.2950	(83)
Total gains	947.9921	1068.4034	1217.1974	1396.1211	1478.0357	1509.3854	1432.1175	1335.2303	1197.4018	1026.5525	926.0453	895.4823	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	78.7897	79.1712	79.1712	79.7149	79.7149	80.3840	80.2228	80.5409	80.3840	80.0576	80.0576	79.5375	
alpha	6.2526	6.2781	6.2781	6.3143	6.3143	6.3589	6.3482	6.3694	6.3589	6.3372	6.3372	6.3025	
util living area													
	0.9953	0.9895	0.9637	0.8627	0.6597	0.4118	0.2701	0.2979	0.5935	0.9148	0.9877	0.9965	(86)
MIT	20.3188	20.4280	20.6295	20.8393	20.9332	20.9504	20.9510	20.9512	20.9442	20.8119	20.5328	20.2993	(87)
Th 2	20.2566	20.2600	20.2600	20.2647	20.2647	20.2704	20.2690	20.2717	20.2704	20.2676	20.2676	20.2631	(88)
util rest of house													
	0.9939	0.9864	0.9536	0.8314	0.6058	0.3521	0.2065	0.2301	0.5232	0.8861	0.9834	0.9955	(89)
MIT 2	19.4526	19.5940	19.8458	20.0951	20.1886	20.2073	20.2062	20.2091	20.2038	20.0731	19.7342	19.4332	(90)
Living area fraction										fLA = Living area / (4) =		0.1963	(91)
MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(92)
Temperature adjustment												0.0000	

adjusted MIT	19.6226	19.7577	19.9996	20.2411	20.3348	20.3532	20.3524	20.3547	20.3491	20.2181	19.8910	19.6032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9839	0.9494	0.8303	0.6111	0.3589	0.2137	0.2379	0.5309	0.8839	0.9807	0.9943	(94)
Useful gains	940.7816	1051.1607	1155.5622	1159.1748	903.2593	541.7697	306.1015	317.6048	635.7564	907.3362	908.1387	890.3360	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1845.7345	1790.6786	1593.6142	1299.0365	921.3842	542.2875	306.1149	317.6306	641.4393	1077.9558	1487.3319	1825.9325	(97)
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98a)
Space heating requirement - total per year (kWh/year)												2850.3810	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2850.3810	
Space heating per m2											(98c) / (4) =	17.8562	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												83.7000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.2850	496.9560	325.9107	100.7005	13.4850	0.0000	0.0000	0.0000	0.0000	126.9410	417.0191	696.0838	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	804.4026	593.7348	389.3796	120.3112	16.1111	0.0000	0.0000	0.0000	0.0000	151.6619	498.2307	831.6413	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	276.5034	244.0189	257.9966	223.9268	215.0799	191.6477	187.5955	196.2643	199.7633	225.3331	242.7491	273.1066	(64)
Efficiency of water heater												88.2000	(216)
(217)m	88.5539	88.5347	88.4784	88.3545	88.2293	88.2000	88.2000	88.2000	88.2000	88.3795	88.5154	88.5585	(217)
Fuel for water heating, kWh/month	312.2432	275.6194	291.5929	253.4414	243.7737	217.2877	212.6934	222.5219	226.4890	254.9608	274.2451	308.3911	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	42.6832	34.2421	30.8312	22.5882	17.4478	14.2550	15.9165	20.6888	26.8728	35.2585	39.8244	43.8695	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.1942	-86.6317	-122.3406	-137.7900	-144.9304	-137.7167	-135.3608	-130.1221	-118.3773	-102.0016	-74.3417	-57.8639	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-45.0993	-82.1451	-161.9009	-255.1189	-328.2640	-360.2998	-350.6974	-303.9307	-220.4025	-128.4640	-62.1540	-35.1719	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3405.4731	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	88.2000	
Water heating fuel used	3093.2594	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	344.4780	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3648.3193	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3280.8912	(238)

10a. Fuel costs - using BEDF prices (599)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3405.4731	6.3400	215.9070	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	6.3400	196.1126	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0000	0.0000	(247a)

Pumps, fans and electric keep-hot	86.0000	26.0000	22.3600	(249)
Energy for lighting	344.4780	26.0000	89.5643	(250)
Additional standing charges			113.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	26.0000	-341.8144	
PV Unit electricity exported	-2333.6484	5.8100	-135.5850	
Total			-477.3994	(252)
Total energy cost			159.5445	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3405.4731	0.2100	715.1493	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3093.2594	0.2100	649.5845	(264)
Space and water heating			1364.7338	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	344.4780	0.1443	49.7188	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	0.1350	-177.4630	
PV Unit electricity exported	-2333.6484	0.1252	-292.2856	
Total			-469.7486	(269)
Total CO2, kg/year			956.6333	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3405.4731	1.1300	3848.1846	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3093.2594	1.1300	3495.3831	(278)
Space and water heating			7343.5677	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	344.4780	1.5338	528.3718	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1314.6708	1.4989	-1970.5576	
PV Unit electricity exported	-2333.6484	0.4596	-1072.6377	
Total			-3043.1953	(283)
Total Primary energy kWh/year			4958.8450	(286)