
164 Harefield Road, Uxbridge

Sustainability statement

June 2024

Revision Schedule

Sustainability statement
June 2024

Rev	Date	Details	Prepared by	Reviewed by	Approved by
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1 Introduction

Planning for Sustainability has been appointed to provide a sustainability statement to support the planning application for the construction of a new three bedroom detached house in the existing garden of 164 Harfield Road, Uxbridge, London.

1.1 Site and development

The site is located in the rear garden of an existing semi-detached house. The area is a residential area on the edge of Uxbridge. The surrounding properties are all residential semi-detached and detached houses with ample garden space. Figure 1 shows the site plan.

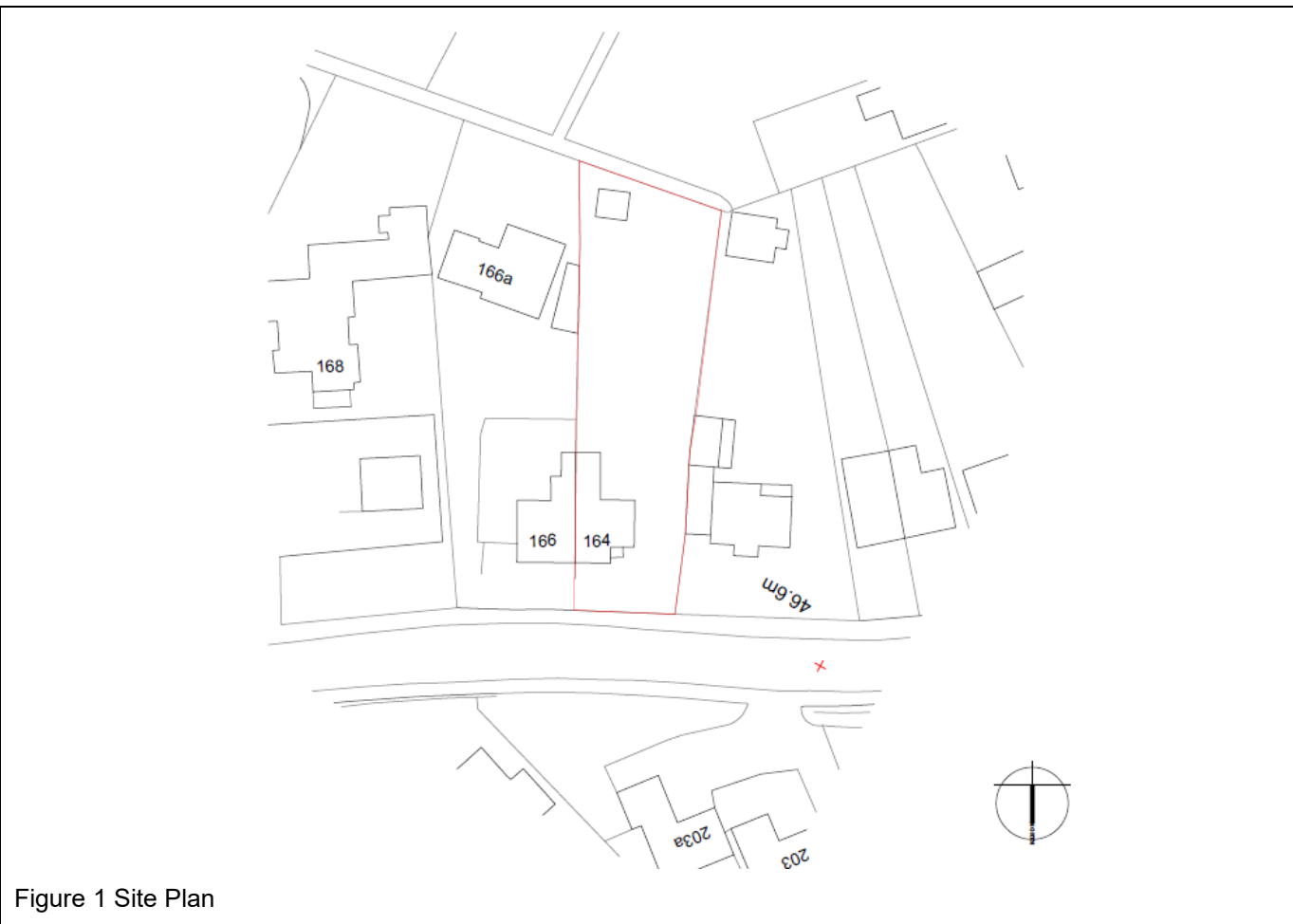


Figure 1 Site Plan

It is proposed to erect a new detached house to the rear of the semi-detached house at 164 Harfield Road. An overview of the design proposal is provided in Appendix 1.

1.2 Sustainability Statement

The formulation of the Sustainability Strategy for the proposal redevelopment has taken into account several important priorities, including:

- Climate change mitigation
 - Reducing emissions of greenhouse gasses
 - Reduction of Urban Heat Island Effect
- Climate change adaptation
 - Overheating
 - Flood Risk
 - Sustainable Drainage
- Resource Management
 - Water use
 - Waste Management
- Pollution control
 - Air Quality
 - Noise
 - Water pollution
- Biodiversity
 - Biodiversity Net Gain

The development is classed as a minor development and is of a residential nature and the strategy that is adopted is appropriate for the scale of the proposed development. Chapter 2 will describe the general sustainability topics and compliance of the proposed development.

2 Requirements and compliance

2.1 Climate Change Mitigation

Reduction of Greenhouse Gas Emissions

The main source of greenhouse gas emissions when considering a small-scale residential development project relates to the energy used as part of the operational phase of the building during its occupancy. There are five elements to this:

1. Space heating
2. Domestic hot water
3. Cooling
4. Cooking
5. Power use of equipment in the house (White Goods, TVs, Computers etc)

The first four elements are included in Approved Document Part L of the Building Regulations and the Hillingdon's local plan¹ includes a policy on these elements:

Policy DMEI 2: Reducing Carbon Emissions

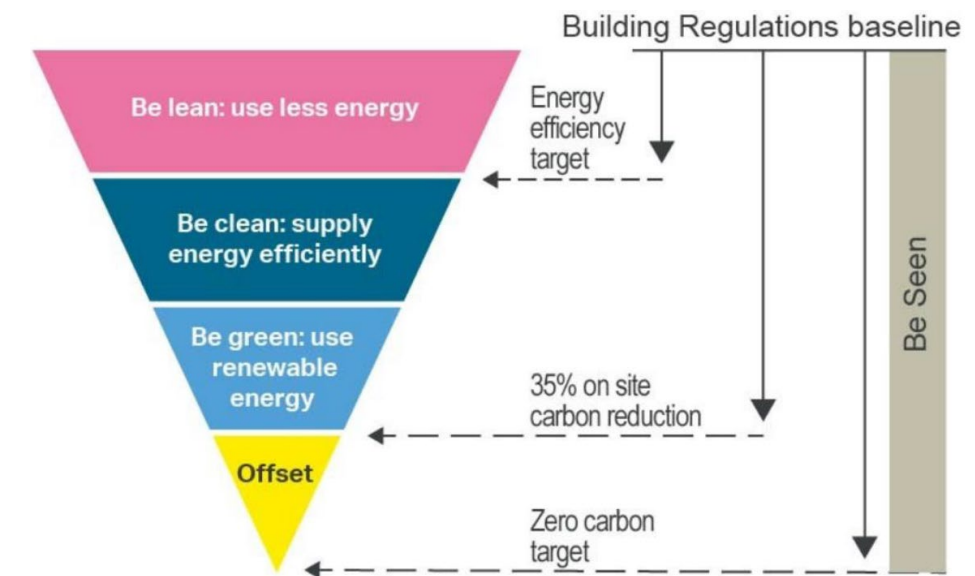
A) All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.

B) All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.

C) Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.

Regulated Carbon Emissions

The London Plan has a minimum target of 35% reduction of carbon emissions of new residential development compared to the Part L (2021) requirements. It is considered that this is easily achieved and therefore a benchmark has been introduced that is currently at 50% reduction but a periodic review is likely to increase the reduction aim. In order to reduce regulated carbon emissions the London Plan considers an Energy Hierarchy (see diagram below)



In the context of the energy hierarchy, energy efficiency is the first stage. Energy demand should be reduced as far as possible before the heating strategy and installation of low carbon and renewable technologies is considered. This has the benefit of reducing the ongoing costs of purchasing energy during its time of occupancy. (Be lean). The next stage (Be Clean) requires the consideration of connecting to heat networks and finally (Be Green), consideration should be given to the installation of low or zero carbon technologies on the development site.

In addressing the changing climate in London, the need for cooling has become an important element to consider. There is a cooling hierarchy, where active mechanically cooled buildings (air conditioning) are only acceptable as a last resort. We carried out an initial assessment using the early stage overheating risk tool published by the Good Homes Alliance. As a detached house in a suburban residential setting with large gardens, the risk of overheating is very low. It is highly likely that natural ventilation will be sufficient to keep the house comfortable during warm summer periods.

Table 1 gives an overview of the measures that are implemented to reduce the carbon emissions associated with the regulated energy use of the proposed development. It follows the steps from nominal baseline through energy efficient building envelope ("Be Lean") to the final proposed measures ("Be Green").

In summary it is proposed to provide space heating and domestic hot water with an air source heat pump, mechanical ventilation with heat recovery and triple glazed windows. There is also a photovoltaic array proposed on the rear roof. An integrated 7 to 8 kWp system will fit on the roof. There are some mature trees nearby and a shading analysis was carried out based on the estimated height of the trees. There is likely some limited shading loss, but not to the extent that the viability of a PV array would be affected. The results of the PV analysis is shown in appendix 3.

¹ London Borough of Hillingdon Local Plan Part 2 – Development Management Policies, adopted 16 January 2020

The specification was used to undertake an energy performance assessment using the standard SAP methodology for residential building for the three scenarios. (Appendix 4 contains the SAP worksheets)

	Carbon Dioxide Emissions for residential buildings (Tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	1.5
After energy demand reduction (be lean)	0.9
After heat network connection (be clean)	0.9
After renewable energy (be green)	0.2

The carbon emissions associated with each scenario is shown in table 1 and table 2 shows the relative improvement made in carbon emission reduction for each of the scenarios.

	Regulated residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.6	43%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.7	43%
Cumulative on site savings	1.3	86%

With the proposed measures the carbon reduction will be 86% of the current Part L requirements, which meets the requirements set out in Hillingdon’s local plan.

Reduction of Urban Heat Island Effect

The temperature in build-up areas is generally higher than in nearby rural areas. This phenomenon is referred to as the Urban Heat Island Effect. Buildings and pavements absorb more of the solar energy than vegetated areas. The proposed development is located in a suburban area, and has a large garden around it. Soft landscaping will be the main finishing form. There are a number of trees in site that will be retained and extended hedging will be provided along part of the boundary.

Table 1 Building Specification SAP assessment

Specification	Notional Baseline	Efficient Baseline (Be Lean)	Proposed Development (Be Green)
Ground floor U-value (W/m2K)	0.12	0.12	0.12
External Wall U-value (W/m2K)	0.18	0.18	0.18
Roof U-value (W/m2K)	0.11	0.11	0.11
Windows U-value (W/m2K)	1.20	0.90	0.90
New dwellings Windows g-value	0.63	0.40	0.40
External doors U-value	1.00	1.00	1.00
Air Permeability	5.00	4.00	4.00
Thermal bridging standalone and 5th floor	y-value 0.05	y-value 0.05 Detailed thermal bridging calculations will be required at detailed design stage	y-value 0.05 Detailed thermal bridging calculations will be required at detailed design stage
Space Heating System and hot water	Gas combi boiler, SEDBUK efficiency 89.5%, radiators, time and temperature zone control; waste water heat recovery system with 36% recovery efficiency; showers flow rate 8 l/min	Gas combi boiler, SEDBUK efficiency 89.5%, radiators, time and temperature zone control; waste water heat recovery system with 36% recovery efficiency; showers flow rate 8 l/min	Air source heat pump Mitsubishi Ecodan PUZ-WM85VAA or equivalent in each flat, underfloor heating with 35°C flow temperature, time and temperature zone control showers flow rate 8 l/min or less
Ventilation System	Natural ventilation with intermittent mechanical extracts	MVHR Nuaire MRXBOXAB-Eco3 or equivalent approved by SAP assessor Supply and extract duct to and from exterior has to be insulated with 25mm insulation if less than 2m long or 50mm thickness for ducts over 2m long	MVHR Nuaire MRXBOXAB-Eco3 or equivalent approved by SAP assessor Supply and extract duct to and from exterior has to be insulated with 25mm insulation if less than 2m long or 50mm thickness for ducts over 2m long
Lighting	Lighting power 2.3 W/m2; Efficacy of all fixed lighting = 80 lm/W	Lighting power 2.3 W/m2; Efficacy of all fixed lighting = 80 lm/W	Lighting power 2.3 W/m2 or less; Efficacy of all fixed lighting = 80 lm/W or higher
New dwellings Solar Photovoltaic	kWp = 40% of dwelling floor area / 6.5	kWp = 40% of dwelling floor area / 6.5	7-8 kWp on south facing roof
% Improvement in CO2 over Building regulations compliant baseline	0.00%		

2.3 Resource Management

Internal water consumption

In accordance with Part G (2010) Building Regulations, internal potable water consumption will be designed to meet the 125 litres/person/day target using practical and hygienic water saving measures.

It also allows the planning authority to set the lower standard of 110 litres/person/day. In the Government's Environmental Improvement Plan 2023 an action is included to lower this standard to 105 l/d/p and, where there is a local need, to 100 l/d/p.

On this topic the Hillingdon's local plan includes a specific policy DMEI 10 on Water management, efficiency and

Policy DMEI 10: Water Management, Efficiency, and Quality

Water Efficiency

G) All new development proposals (including refurbishments and conversions) will be required to include water efficiency measures, including the collection and reuse of rain water and grey water.

H) All new residential development should demonstrate water usage rates of no more than 105 litres/person/day.

quality.

The 105 litres/person/day target may be achieved by installing the following suggested fixtures and fittings:

Water fitting	Maximum consumption
WCs	4/2.6 litres
Wash basin taps	5 litres/min
Showers	8 litres/min
Bath volumes	170 litres
Kitchen taps	6 litres/min
Dishwasher	0.73 l/place setting
Washing machine	8.17 l/kg

This will achieve an internal potable water consumption of 104.6 l/d/p.

External water consumption

To offset the standardised external water 5 l/d/p use rainwater will be collected in rainwater butt for use in the garden.

Waste management

In Hillingdon, household waste is collected in three fractions: recyclable waste (plastics, paper, cardboard and glass), food waste and rest waste. A waste drawer with two compartments (recyclables and rest waste) will be installed in the kitchen and the new house will be signed up for the food waste collection scheme.

2.4 Pollution Control

Water pollution

During the construction stage, United House will adopt best practice policies to prevent water pollution incidents from occurring. These practices can include the following:

- Storing any diesel in tanks/drums and strictly containing them within suitably bunded areas;
- Supervising the deliveries of diesel and liquid chemicals;
- Using drip trays and containers during plant repairs;
- Drawing up plans to deal with any accidental contamination;
- Disposing of any contaminated water and materials using a registered waste management company;
- Carrying out regular checks to ensure sewerage from temporary facilities is discharged into the mains sewage system and not any surface water system;
- Where a suitable sewerage system is unavailable, installing a storage tank to collect sewage from temporary facilities and regularly draining it to prevent overflow into the surface water system; and
- Training site operatives and sub-contractors to adopt the above practices.

Noise

It is intended to provide an air source heat pump to provide space heating for the new house. The external units of Air Source Heat Pumps can emit some level of noise. A combination of selecting a low-noise unit, careful placement and if needed noise insulation around the unit will ensure that no nuisance to neighbours will be caused.

During construction, the construction contractor will aim to protect the neighbourhood's quiet areas and quiet times of day for residents.

- This will involve implementing and maintaining the following noise control measures:
- Adhering to agreed hours of working and delivery arrangements;
- Carefully selecting plant to minimise the potential for noise generation;
- Ensuring plant is inspected and maintained at regular intervals;
- Ensuring that each potential noise generating activity is carried out with appropriate noise reduction equipment (i.e. ensuring baffles and silencers are used);
- Preparing method statements with focus to minimise noisy activities;
- Prohibit the use of transistor radios on site;
- Keeping noise, vibration and dust monitoring results up to date; and
- Establishing a clear point of contact should any issues arise.

Air Quality

The development will reduce emissions through the incorporation of energy efficient design, full electric heating system (air source heat pump), using insulation with a Global Warming Potential of less than 5 and by encouraging sustainable transport behaviour such as cycling.

During the construction stage the construction contractor will be required to adopt best practice policies to prevent air/dust pollution incidents from occurring. These practices can include the following:

- Keeping roads clean using dust suppression systems;
- Ensuring all machinery is subjected to regular inspections and maintenance to maintain operational efficiency and to minimise emissions;
- Minimising dust arising from cutting operations by having pre-cut materials delivered to the site;
- Removing spoil from the site during dry weather and covering it with sheeting or dampening it down; and
- Training site operatives and sub-contractors to adopt the above practices.

2.5 Biodiversity

The proposed development site is located on a domestic garden. The garden mainly comprises lawn with some flower borders. There is a Leylandii hedge and two trees. Although there is some ecological value associated with a domestic garden, it is considered to be low. The Leylandii hedge may provide some shelter for birds and other animals but is considered of low value in itself. The trees provide some additional value.

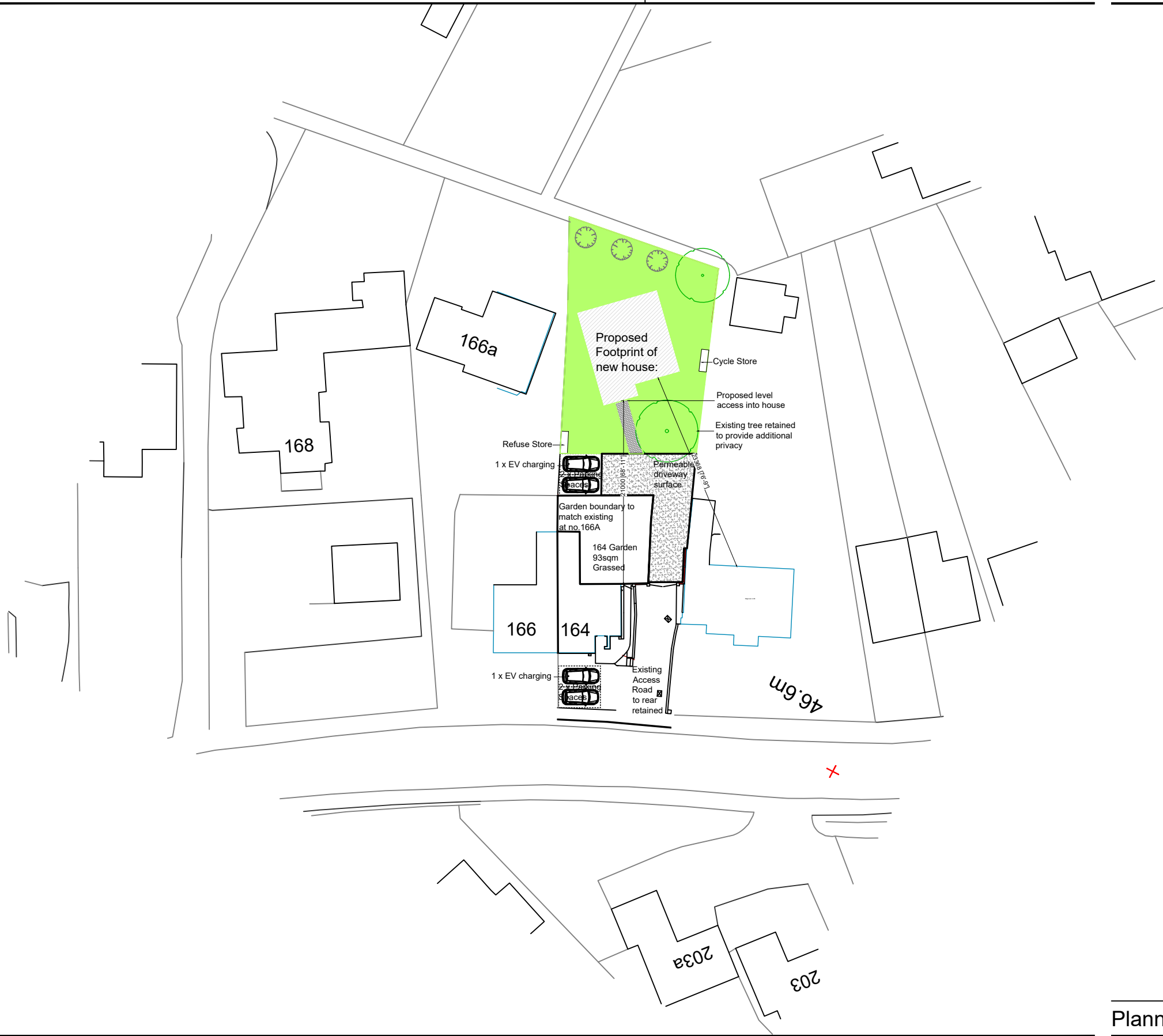
The new house will reduce the area of lawn, but the trees will be retained. In addition, it is proposed to remove the leylandii hedge and replace it with a hedge that contains more native species.

A Biodiversity Net Gain assessment was carried out using the Small Sites Methodology. To ensure the required replacement of lost habitat and the additional 10% new habitat an offside habitat creation solution is being sought.

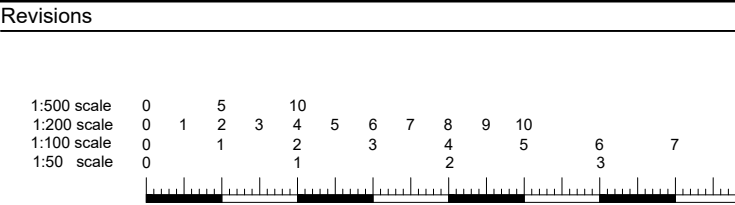
3 Conclusion

A range of measures has been included in the design of the building to enhance the sustainability of the proposed development. Implementation of these measures and the additional construction management principles set out here will ensure that the proposed development complies with national, regional and local requirements.

Appendix 1 Proposed development

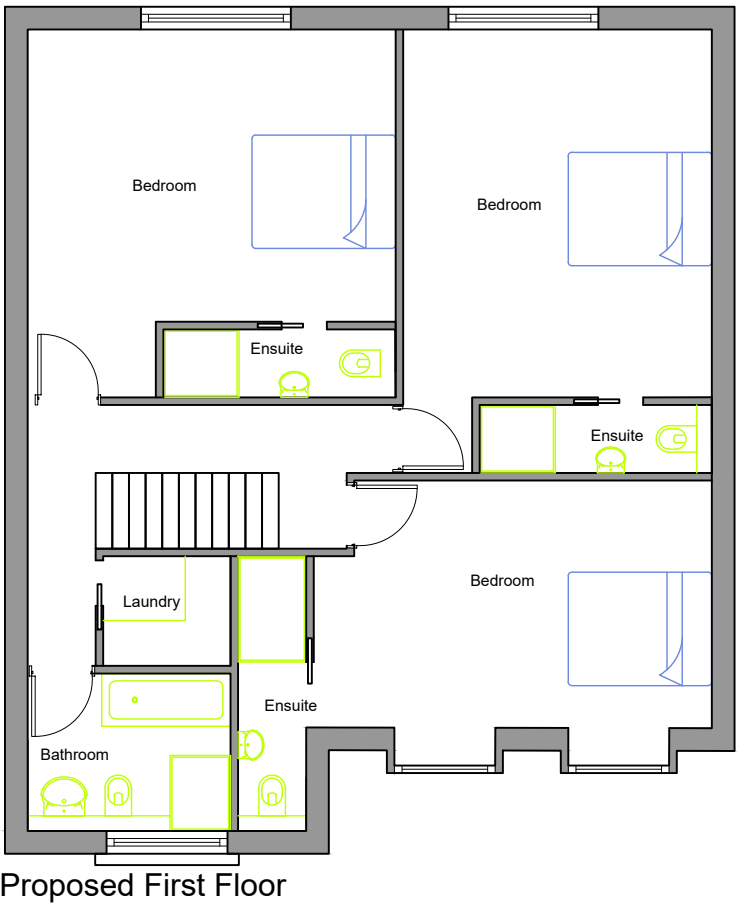
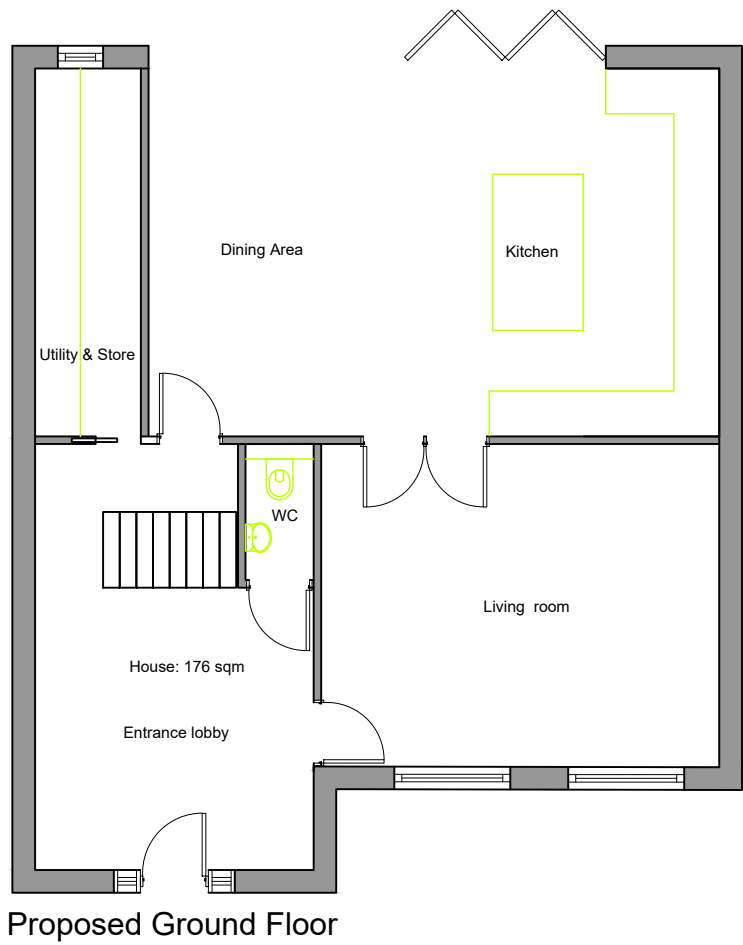


Client
Project
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Drawing title
Proposed Site Plan

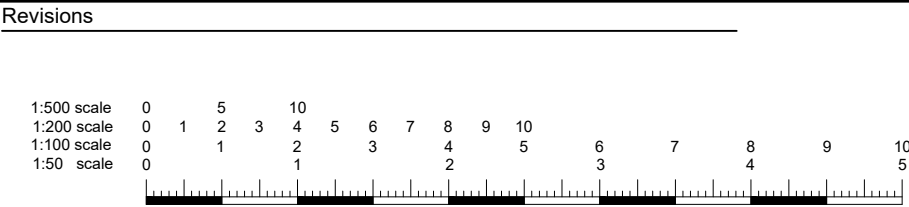


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Planning	File reference
FDR	23777 - F00
Drawn by	Date drawn
FN	July 2024
Checked by	Date checked
RP	4/7/24
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1:500	23777
Drawing number	Revision
102	



Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed Ground & First Floor



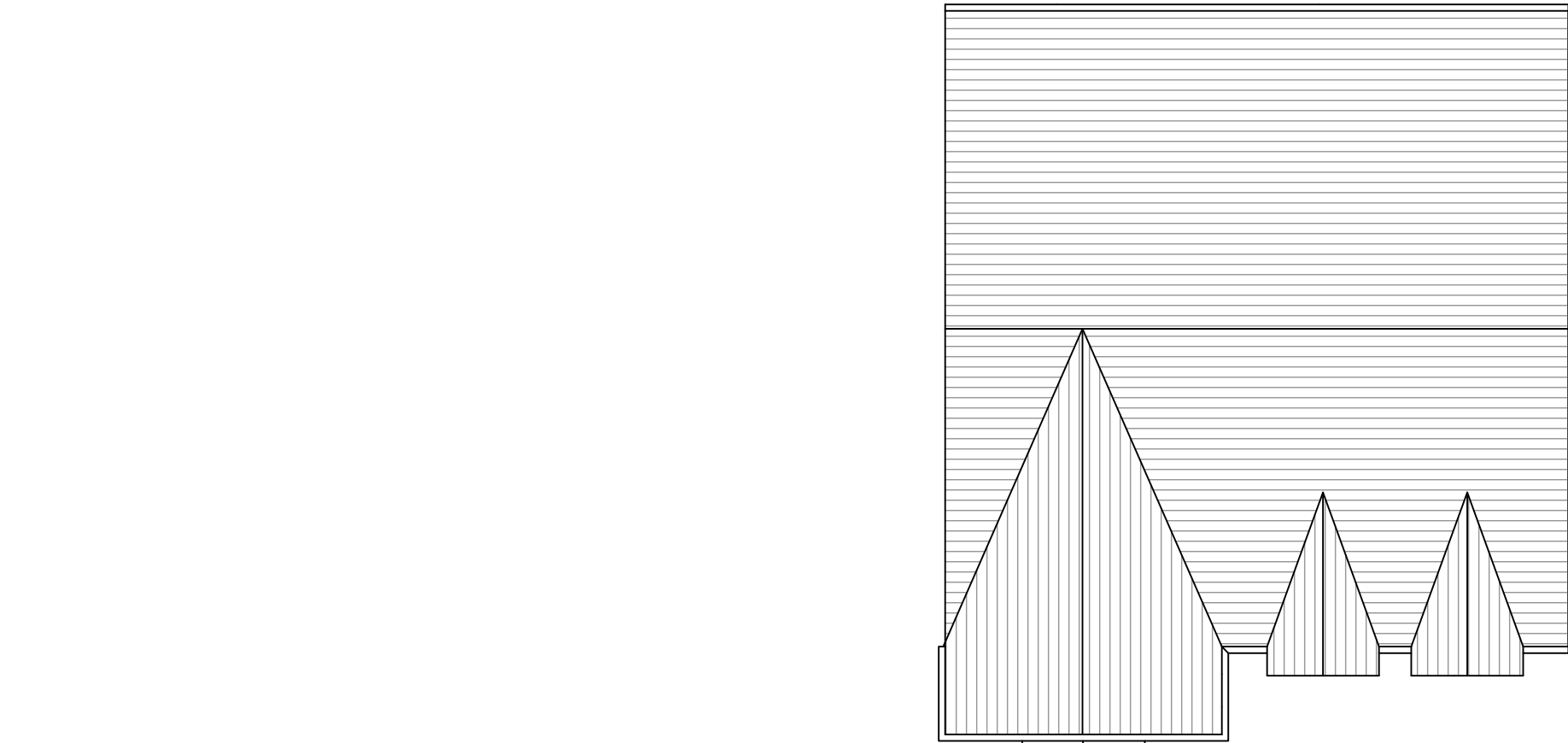
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		Drawn by	Date drawn
		FN	July 2024
		Checked by	Date checked
		RP	4/7/24
Scale at A3	Project number	Drawing number	Revision
1:100	23777	110	



Proposed Roof Plan

Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed Roof Plan

Revisions

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London Fields Studios 11-17 Exmouth Place London E8 3RW T +44(0)20 7993 4530 F +44(0)20 7923 4753
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Planning

FDR

File reference

23777 - F00

Drawn by

FN

Checked by

RP

Scale at A3

1:100

Date drawn

July 2024

Date checked

4/7/24

Drawing number

111

Revision

Project number

23777



Proposed Front Elevation

Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed front elevation

Revisions

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London Fields Studios
11-17 Exmouth Place
London E8 3RW
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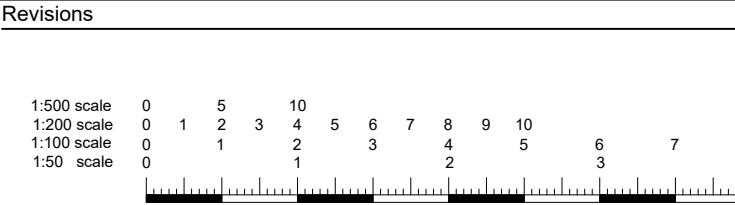
Planning

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Proposed Rear Elevation

Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed rear elevation



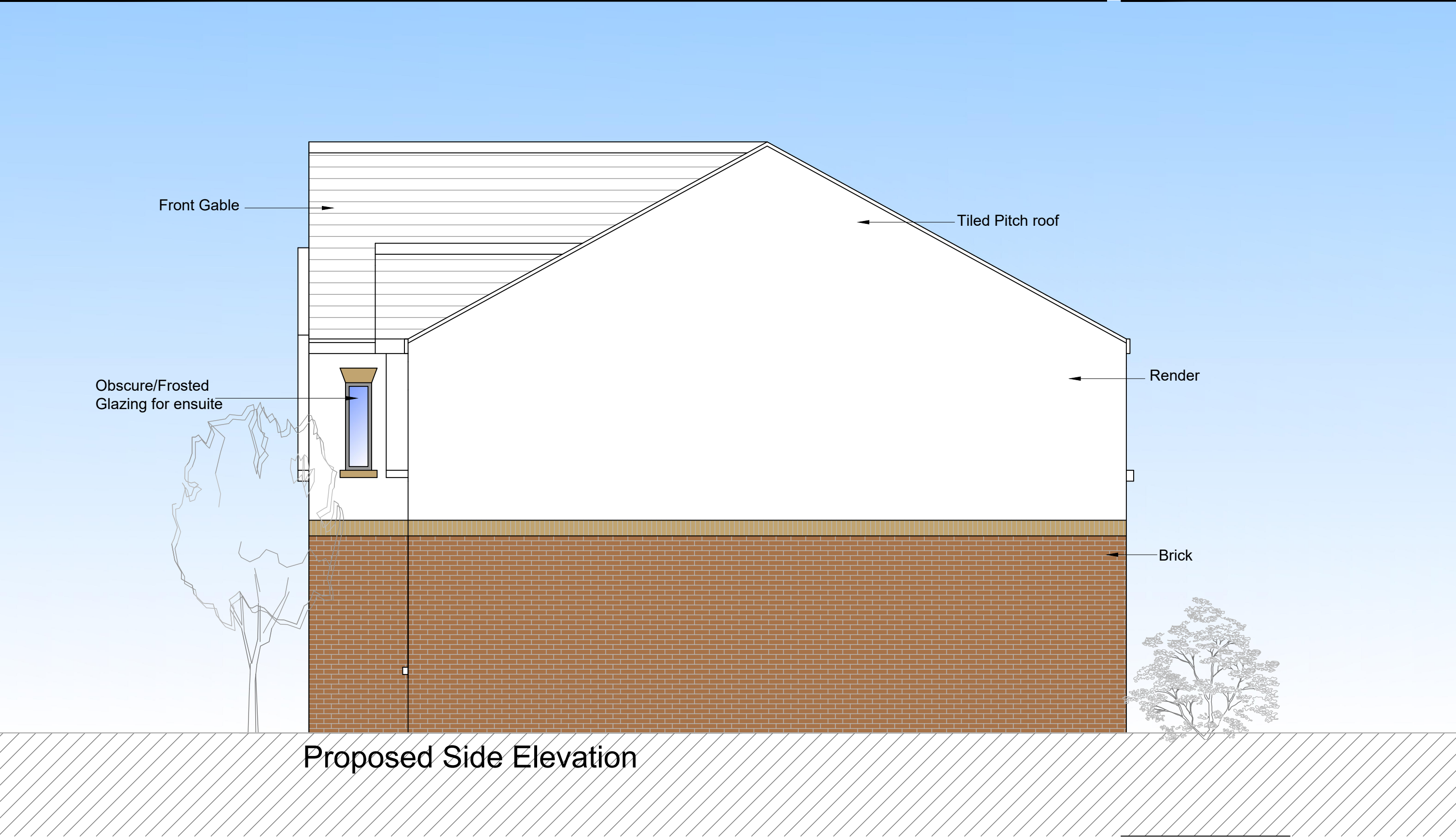
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Planning

FDR		File reference	
		23777 - F00	
		Drawn by	Date drawn
		FN	July 2024
		Checked by	Date checked
		RP	4/7/24
Scale at A3	Project number	Drawing number	Revision
1:50	23777	201	



Proposed Side Elevation

Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed side elevation

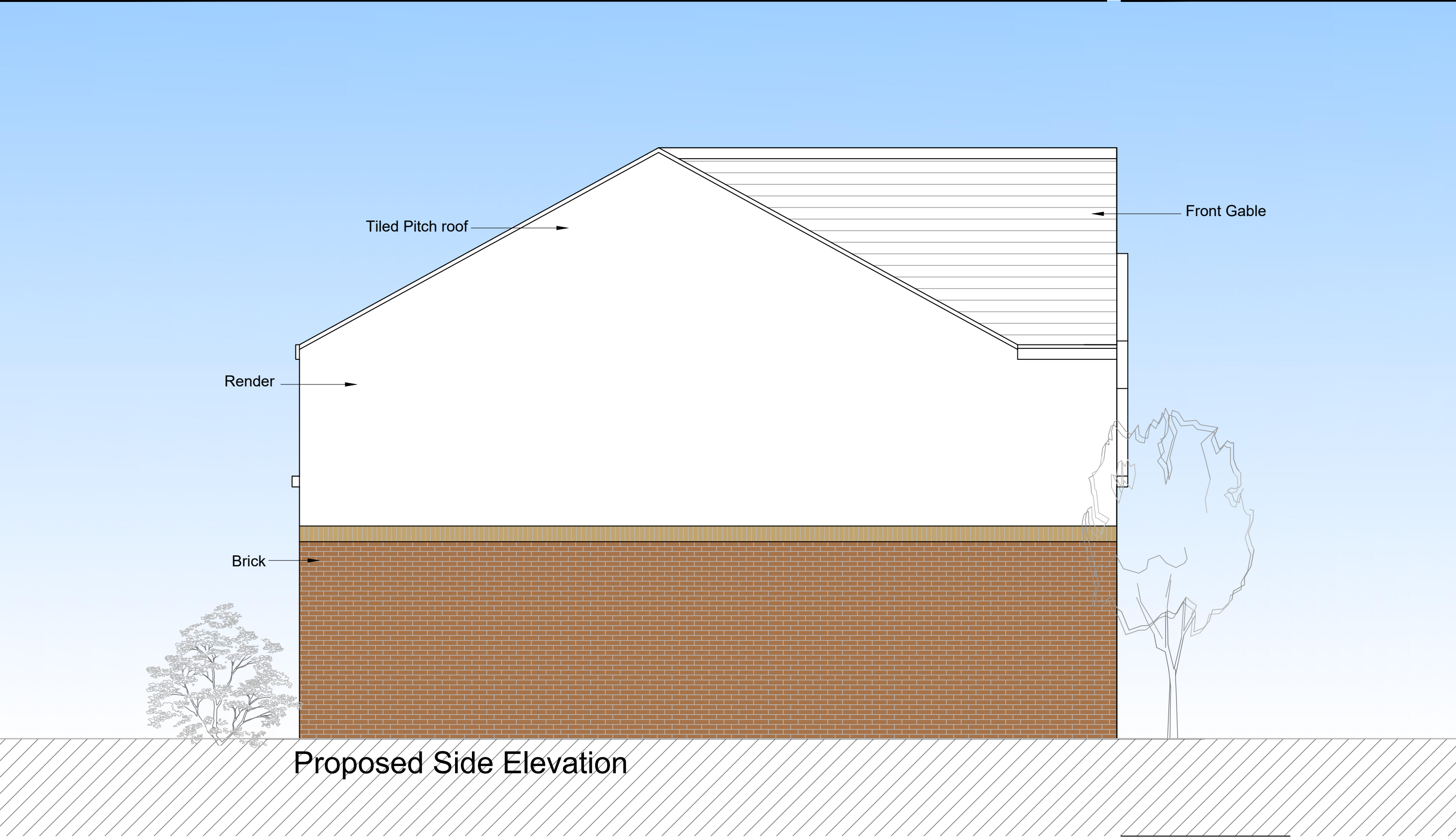
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London E8 3RW
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Planning

<



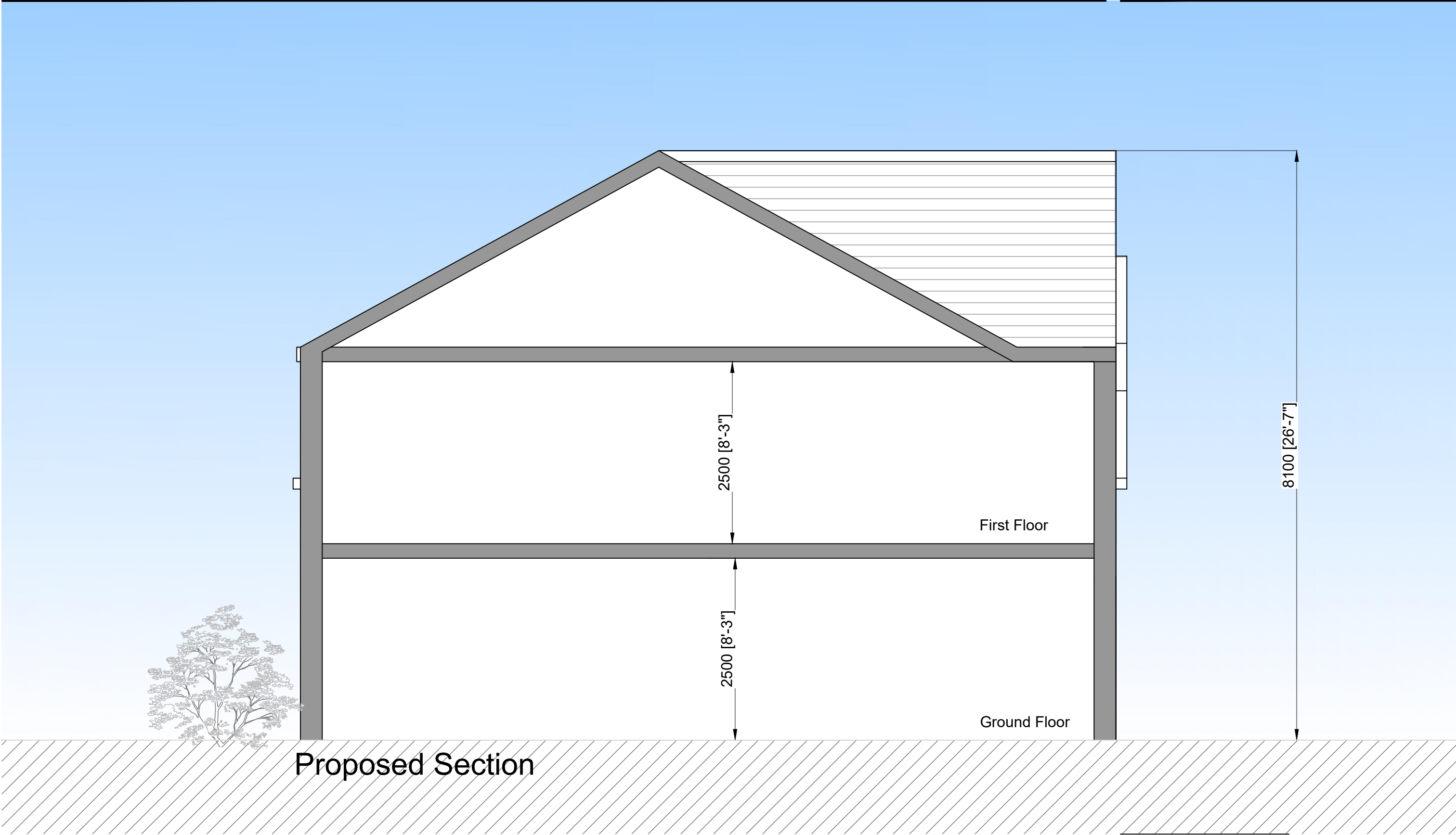
Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed side elevation

Revisions

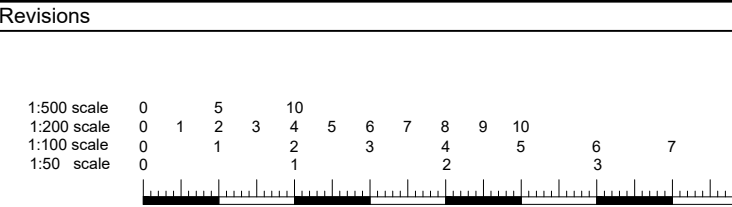
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Planning
File reference
23777 - F00
Drawn by
FN
Checked by
RP
Date drawn
July 2024
Date checked
4/7/24
Scale at A3
1:50
Project number
23777
Drawing number
203
Revision



Client
Project
Rear of 164 Harefield Rd, UB8 1PP
Drawing title
Proposed Section



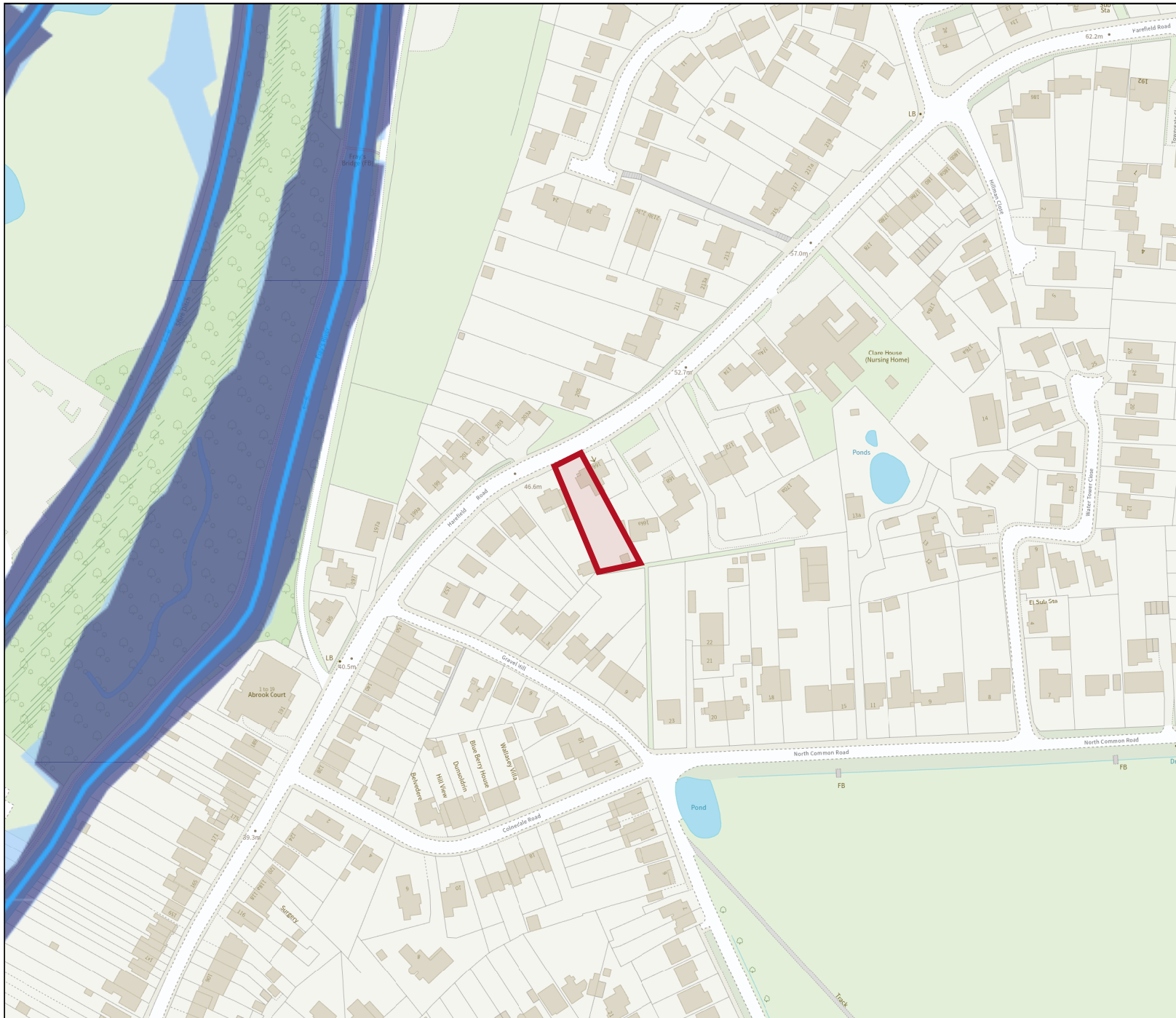
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Planning		File reference	
		23777 - F00	
		Drawn by	Date drawn
		FN	July 2024
		Checked by	Date checked
		RP	4/7/24
Scale at A3	Project number	Drawing number	Revision
1:50	23777	204	

Appendix 2 Flood Risk Map



Flood map for planning

Your reference
164 Harefield

Location (easting/northing)
505844/185176

Scale
1:2500

Created
25 Jun 2024 16:01

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

0 20 40 60m

Appendix 3 Photovoltaic cells output estimate

PVsyst - Simulation report

Grid-Connected System

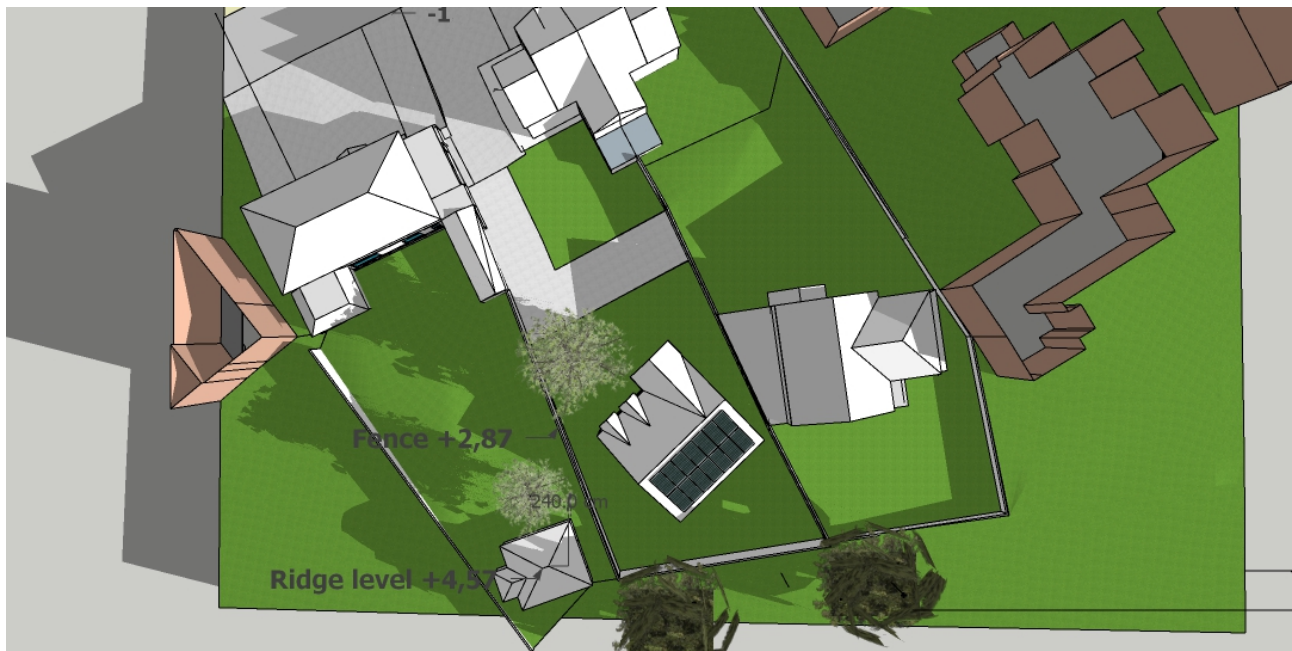
Project: Harfield road

Variant: New simulation variant

Tables on a building

System power: 7.70 kWp

Uxbridge - United Kingdom





Project: Harfield road

Variant: New simulation variant

PVsyst V7.4.0

VC0, Simulation date:
06/26/24 11:53
with v7.4.0

Project summary

Geographical Site

Uxbridge
United Kingdom

Situation

Latitude 51.56 °N
Longitude -0.47 °W
Altitude 50 m
Time zone UTC

Project settings

Albedo 0.20

Meteo data

Uxbridge
PVGIS api TMY

System summary

Grid-Connected System

PV Field Orientation

Fixed plane
Tilt/Azimuth 28.8 / -44.2 °

Tables on a building

Near Shadings

Linear shadings

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules 14 units
Pnom total 7.70 kWp

Inverters

Nb. of units 1 unit
Pnom total 10.00 kWac
Pnom ratio 0.770

Results summary

Produced Energy 7436.25 kWh/year Specific production 966 kWh/kWp/year Perf. Ratio PR 80.45 %

Table of contents

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Near shading definition - Iso-shadings diagram	4
Main results	5
Loss diagram	6
Predef. graphs	7
Single-line diagram	8



Project: Harfield road

Variant: New simulation variant

PVsyst V7.4.0

VC0, Simulation date:
06/26/24 11:53
with v7.4.0

General parameters

Grid-Connected System

PV Field Orientation

Orientation

Fixed plane

Tilt/Azimuth 28.8 / -44.2 °

Horizon

Free Horizon

Tables on a building

Sheds configuration

Nb. of sheds 14 units

Sizes

Sheds spacing 2.03 m

Collector width 2.28 m

Ground Cov. Ratio (GCR) 112.1 %

Shading limit angle

Limit profile angle 88.2 °

Near Shadings

Linear shadings

Models used

Transposition Perez

Diffuse Imported

Circumsolar separate

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer

JA Solar

Model

JAM72-D30-550-MB

(Original PVsyst database)

Unit Nom. Power

550 Wp

Number of PV modules

14 units

Nominal (STC)

7.70 kWp

Modules

2 Strings x 7 In series

At operating cond. (50°C)

Pmpp

7.07 kWp

U mpp

266 V

I mpp

27 A

Total PV power

Nominal (STC)

8 kWp

Total

14 modules

Module area

36.2 m²

Inverter

Manufacturer

Huawei Technologies

Model

SUN2000-10KTL-M2-380V

(Original PVsyst database)

Unit Nom. Power

10.00 kWac

Number of inverters

1 unit

Total power

10.0 kWac

Operating voltage

160-950 V

Max. power (=>60°C)

11.00 kWac

Pnom ratio (DC:AC)

0.77

Power sharing within this inverter

Total inverter power

Total power

10 kWac

Max. power

11 kWac

Number of inverters

1 unit

Pnom ratio

0.77

Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m²K

Uv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res. 165 mΩ

Loss Fraction 1.5 % at STC

Serie Diode Loss

Voltage drop 0.7 V

Loss Fraction 0.2 % at STC

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.2 %

IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	65°	70°	75°	80°	85°	90°
1.000	1.000	0.989	0.945	0.890	0.821	0.681	0.439	0.000

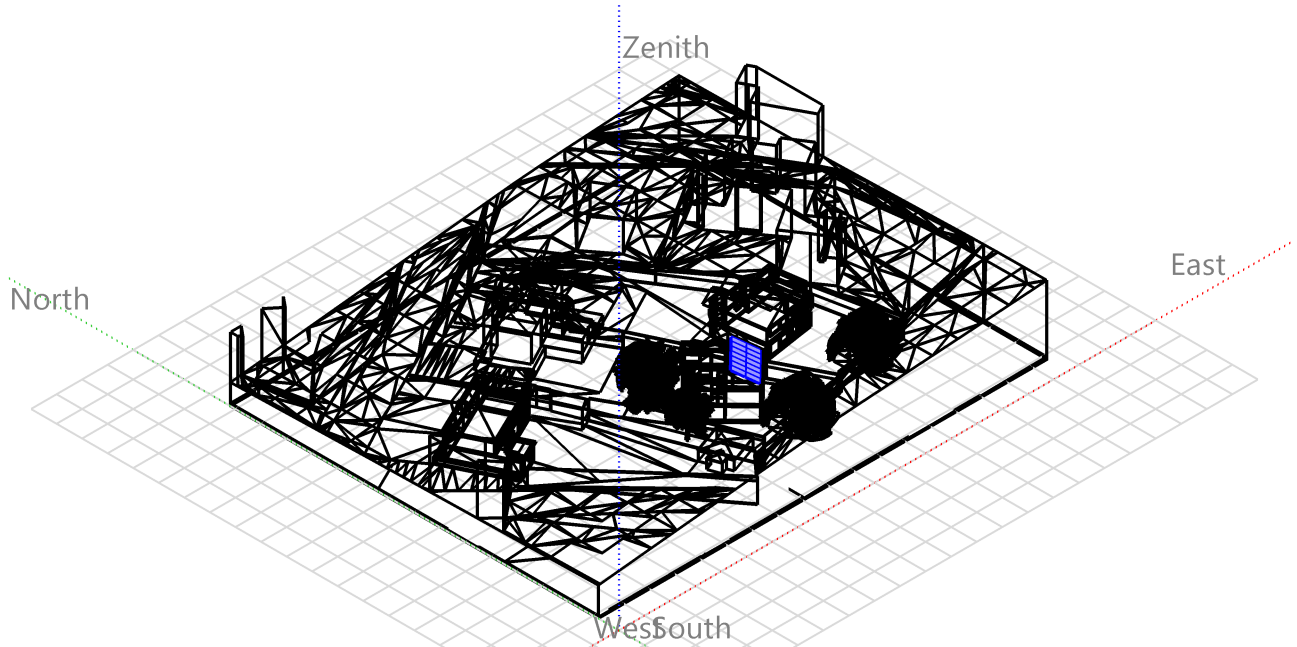


PVsyst V7.4.0

VC0, Simulation date:
06/26/24 11:53
with v7.4.0

Near shadings parameter

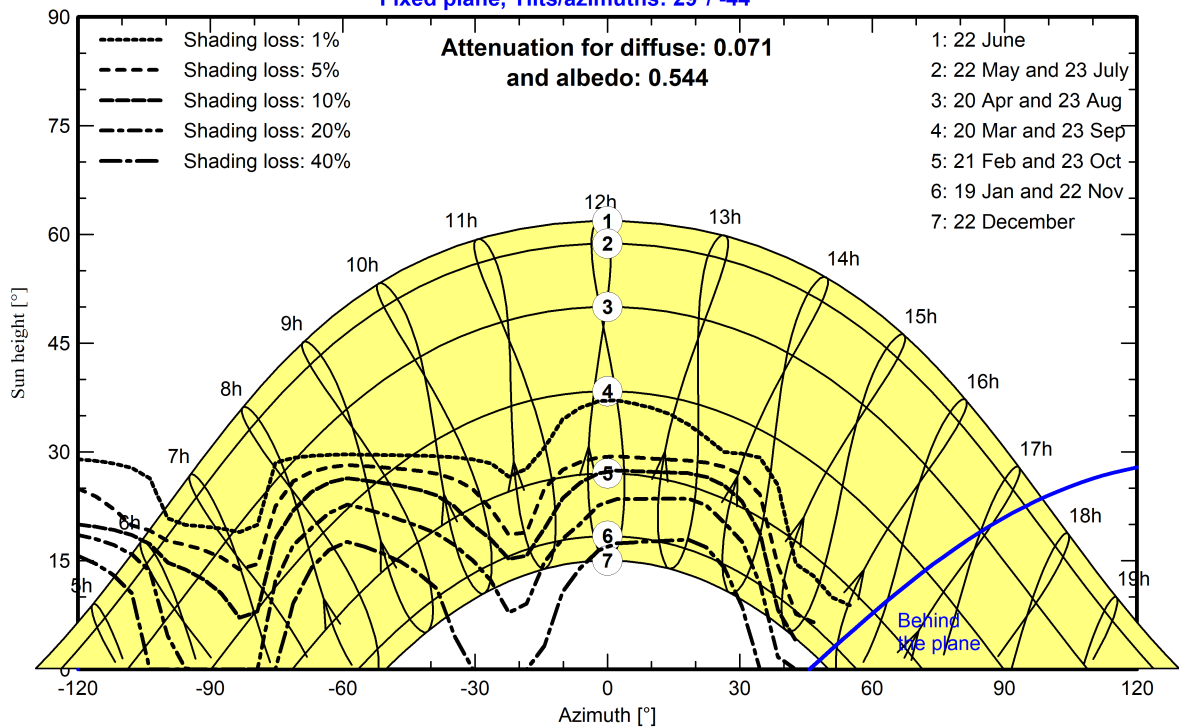
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 29° / -44°





PVsyst V7.4.0

VC0, Simulation date:

06/26/24 11:53

with v7.4.0

Main results

System Production

Produced Energy

7436.25 kWh/year

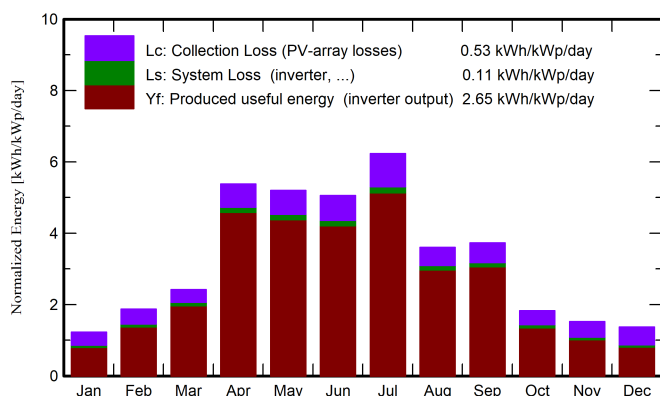
Specific production

966 kWh/kWp/year

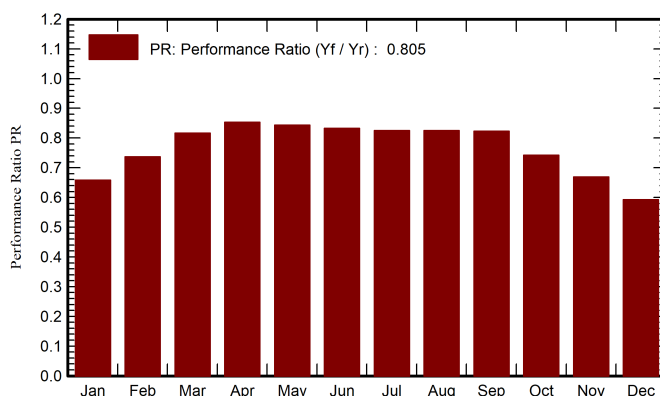
Perf. Ratio PR

80.45 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	kWh	kWh	ratio
January	24.4	14.09	3.01	37.9	27.3	206	192	0.659
February	38.9	25.28	4.00	52.3	41.8	314	296	0.737
March	65.6	44.72	5.29	74.8	65.8	494	470	0.816
April	141.9	60.97	12.24	161.4	150.6	1094	1060	0.853
May	155.8	82.88	12.64	161.0	148.3	1083	1046	0.844
June	150.0	83.21	14.75	151.8	139.2	1008	974	0.833
July	188.4	76.77	19.31	193.1	178.7	1266	1227	0.825
August	105.8	70.58	16.56	111.8	102.3	740	710	0.825
September	96.7	56.47	15.84	111.7	101.3	735	708	0.823
October	45.6	33.44	11.20	56.5	46.7	343	323	0.742
November	30.3	18.07	8.59	45.7	34.1	252	236	0.669
December	23.5	12.73	6.41	42.4	28.0	209	194	0.593
Year	1067.2	579.22	10.85	1200.4	1064.2	7746	7436	0.805

Legends

GlobHor Global horizontal irradiation

DiffHor Horizontal diffuse irradiation

T_Amb Ambient Temperature

GlobInc Global incident in coll. plane

GlobEff Effective Global, corr. for IAM and shadings

EArray Effective energy at the output of the array

E_Grid Energy injected into grid

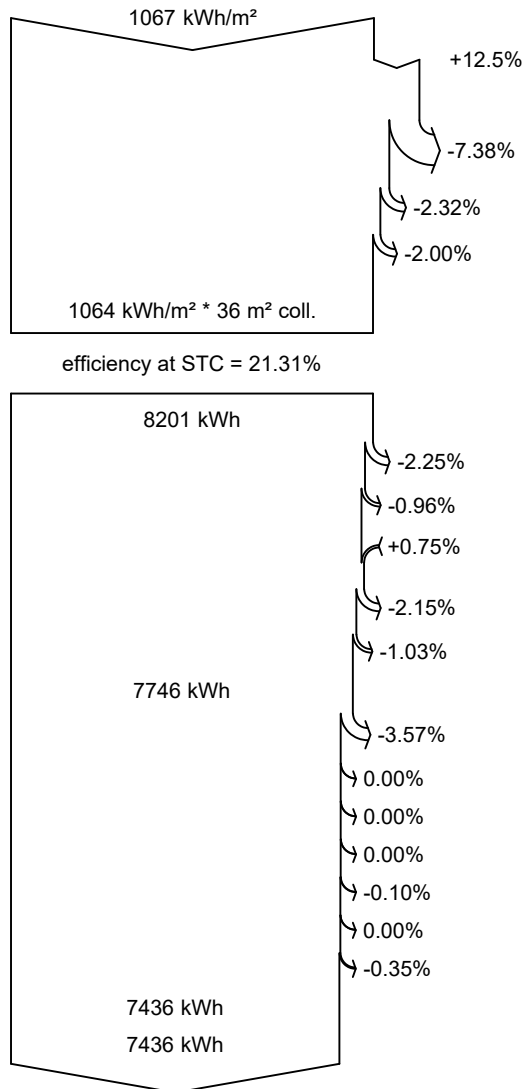
PR Performance Ratio



PVsyst V7.4.0

VC0, Simulation date:
06/26/24 11:53
with v7.4.0

Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

Mismatch loss, modules and strings

Ohmic wiring loss

Array virtual energy at MPP

Inverter Loss during operation (efficiency)

Inverter Loss over nominal inv. power

Inverter Loss due to max. input current

Inverter Loss over nominal inv. voltage

Inverter Loss due to power threshold

Inverter Loss due to voltage threshold

Night consumption

Available Energy at Inverter Output

Energy injected into grid

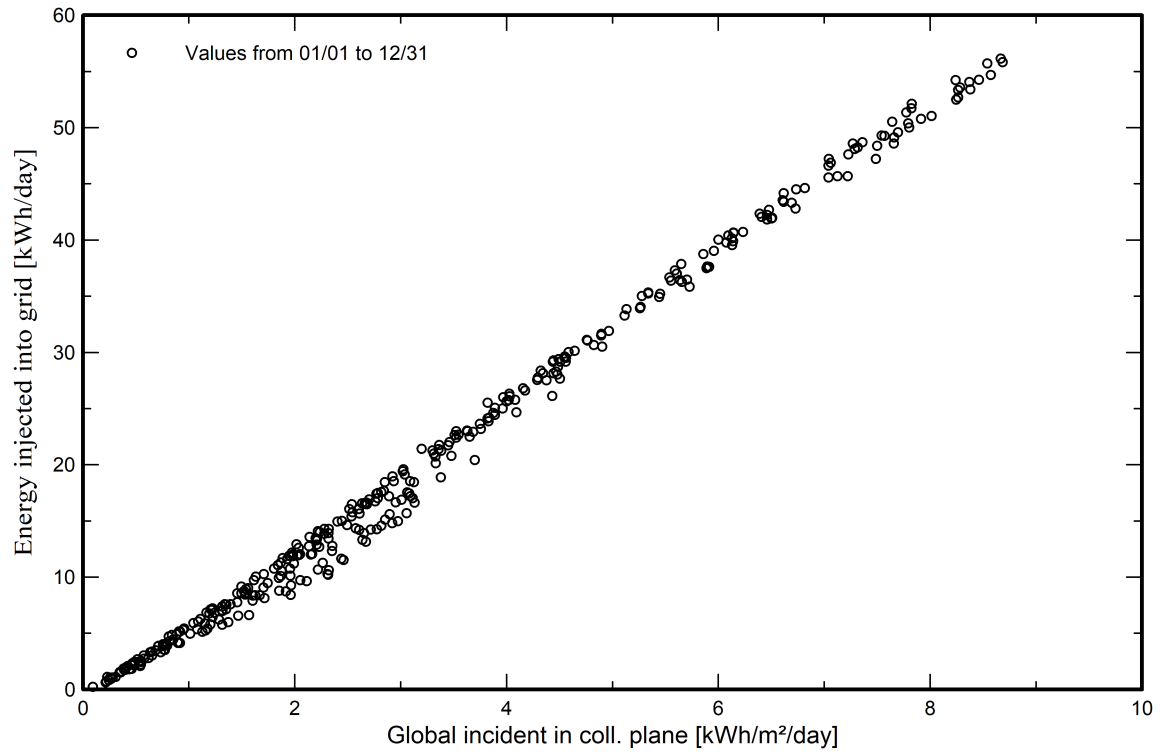


PVsyst V7.4.0

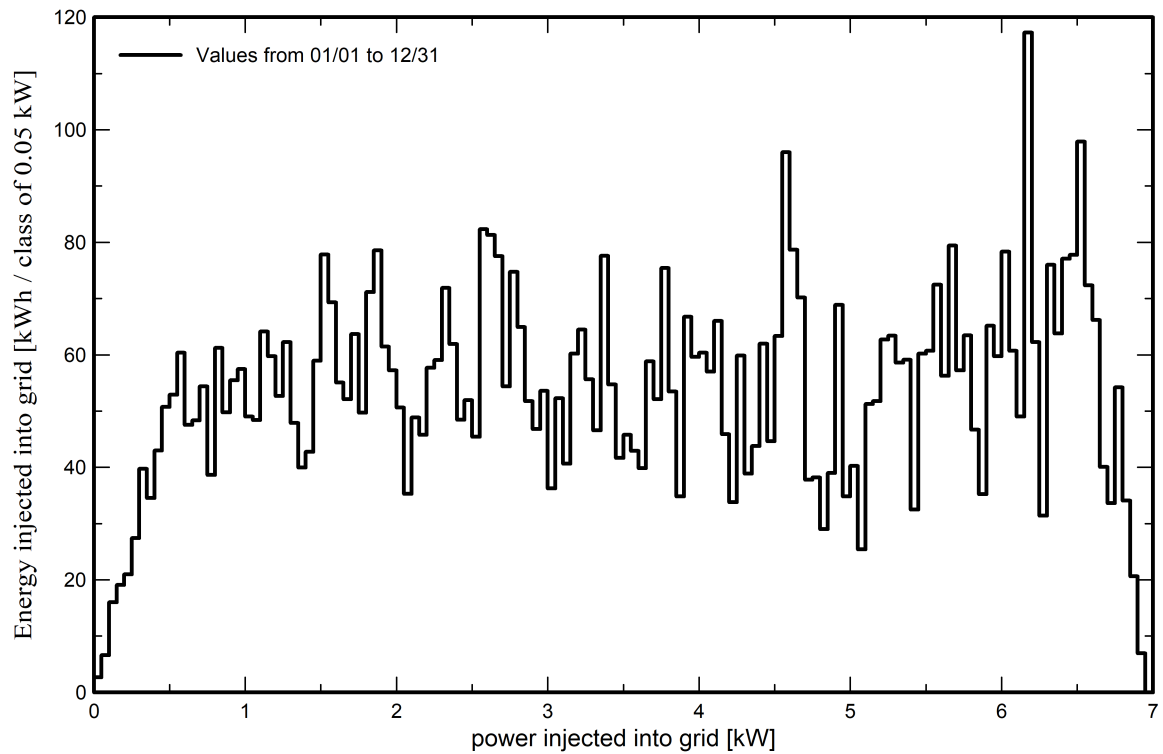
VC0, Simulation date:
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with v7.4.0

Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

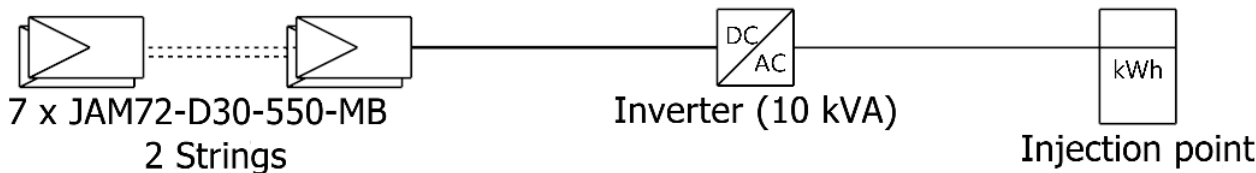




PVsyst V7.4.0

VC0, Simulation date:
06/26/24 11:53
with v7.4.0

Single-line diagram



PV module	JAM72-D30-550-MB
Inverter	SUN2000-10KTL-M2-380V
String	7 x JAM72-D30-550-MB

Harfield road

VC0 : New simulation variant

06/26/24

Appendix 4 SAP worksheets

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 25 Jun 2024 21:52:54

Project Information			
Assessed By	James Gradwell	Building Type	House, Detached
OCDEA Registration	EES/028346	Assessment Date	2024-06-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	178 m ²
Site Reference	Paul Giesberg	Plot Reference	00001
Address			

Client Details	
Name	Paul Giesberg
Company	Planning for sustainability
Address	164 Harefield Road , Uxbridge , UB8 1PP

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	8.49 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	10.23 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	44.5 kWh _{PE} /m ²		
Dwelling primary energy	49.69 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	38.0 kWh/m ²		
Dwelling fabric energy efficiency	31.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	0.9	NORTH (0.9)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	86.29	0.18	
Exposed wall: Walls (2)	85.17	0.18	
Ground floor: Heatloss Floor 1, Heatloss Floor 1	88.62	0.12	
Exposed roof: Roof (1)	89.75	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
NORTH, Glazing	6.55	North	0.7	0.9 (!)
NORTH RENDER , Glazing	7.9	North	0.7	0.9 (!)
SOUTH , Glazing	13.4	South	0.7	0.9 (!)
SOUTH RENDER , Glazing	4.8	South	0.7	0.9 (!)
EAST, Glazing	0.5	East	0.7	0.9 (!)

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.023 (!)	RCD

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.02 (!)	RCD
External wall	E4: Jamb	Not government-approved scheme	0.016 (!)	RCD
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.062	RCD
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0.001 (!)	RCD
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.067	RCD
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.055	RCD
External wall	E13: Gable (insulation at rafter level)	Not government-approved scheme	0.04	RCD
External wall	E16: Corner (normal)	Not government-approved scheme	0.04	RCD
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.07	RCD

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	84.0%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Combi boiler
Manufacturer	Bosch Thermotechnology
Model	Greenstar
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	0.0%
Manufacturer	Building Products Distributors Ltd
Model	Showersave QB1-21 Cyclone

6 Controls

Main heating 1 - type: Programmer, room thermostat, and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	6.5 kWp	
Orientation	South	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Paul Giesberg				Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref		Paul Giesberg		
Property						
SAP Rating	94 A	DER	10.23	TER	8.49	
Environmental	89 B	% DER < TER				-20.49
CO ₂ Emissions (t/year)	1.49	DFEE	31.94	TFEE	38.04	
Compliance Check	See BREL	% DFEE < TFEE				16.03
% DPER < TPER	-11.65	DPER	49.69	TPER	44.50	
Assessor Details	Mr. James Gradwell				Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg					

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

2. Ventilation rate

	m ³ 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) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2897 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2897 (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	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404 (22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983		(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000 (28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000 (29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000 (29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500 (30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 34560.3500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912

Full SAP Calculation Printout



E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	86.9555 (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	83.6161	83.2263	82.8442	81.0495	80.7138	79.1507	79.1507	78.8612	79.7528	80.7138	81.3930	82.1032 (38)
Heat transfer coeff	170.5716	170.1818	169.7997	168.0051	167.6693	166.1062	166.1062	165.8167	166.7083	167.6693	168.3486	169.0587 (39)
Average = Sum(39)m / 12 =												168.0035
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478 (40)
HLP (average)												0.9419
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9737 (42)
Hot water usage for mixer showers												73.7947 (42a)
Hot water usage for baths												31.8713 (42b)
Hot water usage for other uses												45.0834 (42c)
Average daily hot water use (litres/day)												138.9328 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494 (44)
Energy content (annual)	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371 (45)
Distribution loss (46)m = 0.15 x (45)m												2307.6445
Water storage 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												
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 (57)
Combi loss	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363 (61)
Total heat required for water heating calculated for each month	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
12Total per year (kWh/year)												2737.1231 (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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500 (68)
Pumps, fans	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Total internal gains	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640 (72)
	716.2763	736.3686	702.6696	677.5004	639.7789	615.1748	589.1640	589.3226	608.8995	630.6905	672.4494	699.3422 (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					14.4500	10.6334	0.6300		0.7000		0.7700	46.9582 (74)		
East					0.5000	19.6403	0.6300		0.7000		0.7700	3.0012 (76)		
South					18.2000	46.7521	0.6300		0.7000		0.7700	260.0423 (78)		
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)		
Total gains	1026.2780	1257.8613	1407.3260	1549.6795	1625.9438	1600.9735	1536.5651	1448.8678	1370.1898	1203.8340	1042.3593	965.6573 (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	

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tau	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251	56.7856
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017	4.7857
util living area	0.9950	0.9866	0.9690	0.9188	0.8103	0.6304	0.4688	0.5152	0.7492	0.9412	0.9885	0.9962 (86)
MIT	19.8881	20.0759	20.3053	20.5856	20.7967	20.9052	20.9301	20.9269	20.8648	20.5846	20.1831	19.8573 (87)
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304	20.1271 (88)
util rest of house	0.9937	0.9832	0.9612	0.8983	0.7657	0.5576	0.3805	0.4243	0.6821	0.9220	0.9851	0.9952 (89)
MIT 2	19.0932	19.2809	19.5079	19.7832	19.9721	20.0612	20.0752	20.0753	20.0328	19.7884	19.3956	19.0686 (90)
Living area fraction	19.1933	19.3810	19.6083	19.8842	20.0759	20.1675	20.1829	20.1826	20.1375	19.8887	19.4948	19.1679 (92)
MIT	19.1933	19.3810	19.6083	19.8842	20.0759	20.1675	20.1829	20.1826	20.1375	19.8887	19.4948	19.1679 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1933	19.3810	19.6083	19.8842	20.0759	20.1675	20.1829	20.1826	20.1375	19.8887	19.4948	19.1679 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9919	0.9797	0.9555	0.8915	0.7624	0.5599	0.3849	0.4287	0.6821	0.9154	0.9818	0.9938 (94)
Useful gains	1017.9930	1232.2714	1344.7486	1381.4929	1239.6166	896.4225	591.4704	621.0845	934.5835	1102.0193	1023.3996	959.6936 (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	2540.3779	2464.4057	2225.7815	1845.4024	1404.3883	924.7965	595.1384	627.2113	1006.5062	1557.4294	2086.6405	2530.4492 (97)
Space heating kWh	1132.6544	827.9943	655.4885	334.0148	122.5901	0.0000	0.0000	0.0000	0.0000	338.8251	765.5335	1168.6421 (98a)
Space heating requirement - total per year (kWh/year)												5345.7428
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	1132.6544	827.9943	655.4885	334.0148	122.5901	0.0000	0.0000	0.0000	0.0000	338.8251	765.5335	1168.6421 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5345.7428
Space heating per m2										(98c) / (4) =		29.9700 (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 %)												84.0000 (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	1132.6544	827.9943	655.4885	334.0148	122.5901	0.0000	0.0000	0.0000	0.0000	338.8251	765.5335	1168.6421 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1348.3981	985.7074	780.3435	397.6367	145.9406	0.0000	0.0000	0.0000	0.0000	403.3632	911.3494	1391.2406 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
Efficiency of water heater (217)m	88.5195	88.4428	88.3091	88.0202	87.4546	86.6000	86.6000	86.6000	86.6000	88.0247	88.4103	86.6000 (216)
Fuel for water heating, kWh/month	311.6967	275.4594	291.9417	254.7404	246.6438	222.3592	217.9136	227.7111	231.4819	256.4025	274.4509	307.8675 (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	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-95.6263	-123.4667	-162.7327	-168.9607	-172.3835	-157.4893	-155.4666	-151.3021	-143.6692	-133.5540	-101.1240	-84.2697 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												6363.9796 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												86.6000
Water heating fuel used												3118.6688 (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)												325.0287 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1650.0447 (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)

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Total delivered energy for all uses

8243.6324 (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	6363.9796	0.2100	1336.4357 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3118.6688	0.2100	654.9205 (264)
Space and water heating			1991.3562 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1650.0447	0.1363	-224.9539
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-224.9539 (269)
Total CO2, kg/year			1825.2432 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.2300 (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	6363.9796	1.1300	7191.2969 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3118.6688	1.1300	3524.0958 (278)
Space and water heating			10715.3927 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1650.0447	1.5040	-2481.5862
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2481.5862 (283)
Total Primary energy kWh/year			8862.4471 (286)
Dwelling Primary energy Rate (DPER)			49.6900 (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)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

2. Ventilation rate

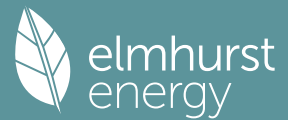
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3397 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580			(27)
Heatloss Floor 1			88.6200	0.1300	11.5206			(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322			(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306			(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725			(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.2139			(33)

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

List of Thermal Bridges

193.7565 (35)

	Length	Psi-value	Total	
K1 Element	20.5100	0.0500	1.0255	
E2 Other lintels (including other steel lintels)	11.8900	0.0500	0.5945	
E3 Sill	32.7900	0.0500	1.6395	
E4 Jamb	39.3500	0.1600	6.2960	
E5 Ground floor (normal)	41.2600	0.0000	0.0000	
E6 Intermediate floor within a dwelling	15.8900	0.0600	0.9534	
E10 Eaves (insulation at ceiling level)	19.8400	0.0600	1.1904	
E12 Gable (insulation at ceiling level)	6.2000	0.0800	0.4960	
E13 Gable (insulation at rafter level)	25.7100	0.0900	2.3139	
E16 Corner (normal)	5.1400	-0.0900	-0.4626	
E17 Corner (inverted - internal area greater than external area)				

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

14.0466 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 104.2605 (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	87.3802	86.8442	86.3189	83.8513	83.3896	81.2404	81.2404	80.8424	82.0683	83.3896	84.3236	85.3000	(38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605	(39)
Average = Sum(39)m / 12 =													188.1096

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0744	1.0714	1.0684	1.0546	1.0520	1.0400	1.0400	1.0377	1.0446	1.0520	1.0573	1.0627	(40)
HLP (average)												1.0546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)													138.9328 (43)
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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													
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	(57)
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	290.3298	256.6546	272.2559	238.2396	230.2092	206.6271	203.2614	211.7333	214.5155	240.1903	256.6319	286.9960	(62)
WWHRS	-33.8656	-29.9510	-31.3630	-25.9698	-24.2029	-20.7106	-19.4129	-20.6437	-21.4280	-25.2612	-28.6179	-33.2385	(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	256.4642	226.7036	240.8929	212.2698	206.0062	185.9165	183.8485	191.0897	193.0875	214.9291	228.0139	253.7575	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2592.9794	(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)
												0.0000	(64a)
Heat gains from water heating, kWh/month	92.3306	81.5404	86.3210	75.1462	72.3404	64.6350	63.3803	66.1972	67.2579	75.6592	81.2616	91.2221	(65)

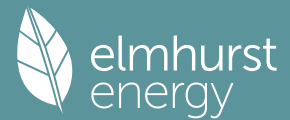
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	124.1002	121.3399	116.0228	104.3697	97.2318	89.7709	85.1886	88.9748	93.4138	101.6924	112.8633	122.6103	(72)
Total internal gains	724.1210	744.2163	710.5233	685.3672	647.6538	620.0582	594.0525	594.2069	613.7787	638.5603	680.3067	707.1885	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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	m2				Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d	W	
North	14.4500				10.6334	0.6300		0.7000		0.7700	46.9582 (74)	
East	0.5000				19.6403	0.6300		0.7000		0.7700	3.0012 (76)	
South	18.2000				46.7521	0.6300		0.7000		0.7700	260.0423 (78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1034.1226	1265.7091	1415.1797	1557.5464	1633.8187	1605.8569	1541.4536	1453.7520	1375.0691	1211.7039	1050.2166	973.5036 (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	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062	50.6440
alpha	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937	4.3763
util living area	0.9950	0.9875	0.9728	0.9318	0.8410	0.6770	0.5143	0.5621	0.7876	0.9499	0.9891	0.9961 (86)
MIT	19.3856	19.6409	19.9677	20.3840	20.7227	20.9251	20.9825	20.9742	20.8483	20.4018	19.8189	19.3490 (87)
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359	20.0314 (88)
util rest of house	0.9936	0.9843	0.9656	0.9129	0.7972	0.5972	0.4103	0.4567	0.7188	0.9321	0.9858	0.9951 (89)
MIT 2	18.1278	18.4544	18.8694	19.3929	19.7885	20.0002	20.0429	20.0404	19.9315	19.4246	18.6911	18.0875 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.2862	18.6038	19.0077	19.5177	19.9061	20.1167	20.1612	20.1580	20.0469	19.5477	18.8332	18.2464 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2862	18.6038	19.0077	19.5177	19.9061	20.1167	20.1612	20.1580	20.0469	19.5477	18.8332	18.2464 (93)
8. Space heating requirement												
Utilisation	0.9901	0.9777	0.9554	0.9003	0.7903	0.6032	0.4229	0.4690	0.7189	0.9203	0.9798	0.9922 (94)
Useful gains	1023.8748	1237.4455	1352.0539	1402.2831	1291.1497	968.6764	651.8235	681.7889	988.4893	1115.1681	1028.9540	965.9123 (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	2680.3204	2618.8670	2383.7167	1997.3075	1539.8838	1023.3472	660.6061	695.6083	1108.0856	1679.0347	2212.6860	2662.6388 (97)
Space heating kWh	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (98a)
Space heating requirement - total per year (kWh/year)	6075.9120											
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	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	6075.9120											
Space heating per m2	(98c) / (4) =											34.0635 (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	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (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)	1333.7614	1004.6702	830.6896	463.6554	200.2794	0.0000	0.0000	0.0000	0.0000	454.0225	922.3885	1366.1954 (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	256.4642	226.7036	240.8929	212.2698	206.0062	185.9165	183.8485	191.0897	193.0875	214.9291	228.0139	253.7575 (64)
Water heating requirement	87.2897	87.0697	86.6824	85.8536	84.1523	80.3000	80.3000	80.3000	80.3000	85.7875	86.9349	80.3000 (216)
Fuel for water heating, kWh/month	293.8082	260.3702	277.9029	247.2462	244.8016	231.5274	228.9520	237.9697	240.4577	250.5366	262.2814	290.5582 (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	37.2806	29.9079	26.9287	19.7291	15.2393	12.4507	13.9018	18.0701	23.4713	30.7956	34.7836	38.3167 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-75.4014	-102.6818	-142.5704	-154.5687	-161.8547	-149.1948	-147.1295	-141.0701	-129.9310	-114.4155	-81.5024	-65.6023 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-54.3557	-112.7574	-221.3379	-328.5901	-430.9550	-431.9160	-427.0296	-363.3355	-268.5563	-160.1892	-72.1962	-43.1238 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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												6575.6623 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3066.4120 (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)	300.8756 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4380.2655 (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	5648.6843 (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	6575.6623	0.2100	1380.8891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3066.4120	0.2100	643.9465 (264)
Space and water heating			2024.8356 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	300.8756	0.1443	43.4256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1465.9227	0.1354	-198.4477
PV Unit electricity exported	-2914.3428	0.1262	-367.8831
Total			-566.3308 (269)
Total CO2, kg/year			1513.8597 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.4900 (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	6575.6623	1.1300	7430.4984 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3066.4120	1.1300	3465.0455 (278)
Space and water heating			10895.5439 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	300.8756	1.5338	461.4930 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1465.9227	1.5004	-2199.4159
PV Unit electricity exported	-2914.3428	0.4634	-1350.4256
Total			-3549.8415 (283)
Total Primary energy kWh/year			7937.2962 (286)
Target Primary Energy Rate (TPER)			44.5000 (287)

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

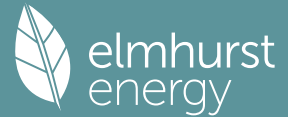
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2897 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)

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Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.2897 \quad (21)$$

	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	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404	(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	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579	(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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	80.1680		(33)

$$\text{Heat capacity Cm} = \text{Sum}(A \times k) \quad (28) \dots (30) + (32) + (32a) \dots (32e) = 34560.3500 \quad (34)$$

$$\text{Thermal mass parameter (TMP} = \text{Cm} / \text{TFA) in kJ/m2K} \quad 193.7565 \quad (35)$$

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	20.5100	0.0230	0.4717	
E2 Other lintels (including other steel lintels)	11.8900	0.0200	0.2378	
E3 Sill	32.7900	0.0160	0.5246	
E4 Jamb	39.3500	0.0620	2.4397	
E5 Ground floor (normal)	41.2600	0.0010	0.0413	
E6 Intermediate floor within a dwelling	15.8900	0.0670	1.0646	
E10 Eaves (insulation at ceiling level)	19.8400	0.0550	1.0912	
E12 Gable (insulation at ceiling level)	6.2000	0.0400	0.2480	
E13 Gable (insulation at rafter level)	25.7100	0.0400	1.0284	
E16 Corner (normal)	5.1400	-0.0700	-0.3598	
E17 Corner (inverted - internal area greater than external area)				6.7876 (36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				(36a) = 0.0000
Point Thermal bridges				(33) + (36) + (36a) = 86.9555 (37)
Total fabric heat loss				

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	83.6161	83.2263	82.8442	81.0495	80.7138	79.1507	79.1507	78.8612	79.7528	80.7138	81.3930	82.1032 (38)
Heat transfer coeff	170.5716	170.1818	169.7997	168.0051	167.6693	166.1062	166.1062	165.8167	166.7083	167.6693	168.3486	169.0587 (39)
Average = Sum(39)m / 12 =												168.0035
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478 (40)
HLP (average)												0.9419
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

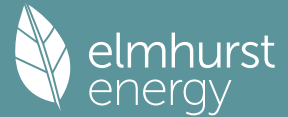
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (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	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												70.6348	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547	(44)
Energy conte	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924	(45)
Energy content (annual)										Total = Sum(45)m =		1173.0939	
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:													
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	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186	(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	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		997.1298	(64)
Electric shower(s)	59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												674.8135	(64a)
Heat gains from water heating, kWh/month	40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358	(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	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500 (68)
Pumps, fans	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Total internal gains	54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011	54.3492 (72)
	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445	635.9273 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	W
North					14.4500	10.6334		0.6300		0.7000	0.7700	46.9582 (74)
East					0.5000	19.6403		0.6300		0.7000	0.7700	3.0012 (76)
South					18.2000	46.7521		0.6300		0.7000	0.7700	260.0423 (78)
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948	1496.9547	1407.0775	1325.7666	1154.0758	985.2544	902.2425 (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	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251	56.7856
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017	4.7857
util living area	0.9962	0.9891	0.9736	0.9271	0.8231	0.6443	0.4804	0.5291	0.7651	0.9491	0.9908	0.9972 (86)
MIT	19.5562	19.8093	20.1207	20.5061	20.8004	20.9546	20.9910	20.9859	20.8957	20.5029	19.9554	19.5150 (87)
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304	20.1271 (88)
util rest of house	0.9952	0.9863	0.9668	0.9081	0.7797	0.5710	0.3903	0.4364	0.6990	0.9319	0.9881	0.9964 (89)
MIT 2	18.7900	19.0427	19.3510	19.7281	19.9929	20.1175	20.1381	20.1374	20.0768	19.7326	19.1958	18.7545 (90)
Living area fraction	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (92)
MIT	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (93)
Temperature adjustment	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (93)
adjusted MIT	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9933	0.9822	0.9602	0.9002	0.7775	0.5784	0.4015	0.4477	0.7025	0.9244	0.9844	0.9949 (94)
Useful gains	955.3420	1173.5192	1293.7529	1348.1001	1227.1297	901.1285	601.0507	629.9280	931.3379	1066.8272	969.9318	897.6607 (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	2488.0439	2423.2642	2198.5471	1835.6324	1407.5178	933.9917	605.5342	637.4347	1013.5745	1547.5234	2052.4144	2476.7531 (97)
Space heating kWh	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875	1174.8447 (98a)
Space heating requirement - total per year (kWh/year)												5450.4278
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	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875	1174.8447 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5450.4278
Space heating per m2												30.5569 (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	1561.3983	1229.1859	1260.2073	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8706	0.9286	0.9063	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1359.2843	1141.4221	1142.1362	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1739.0773	1671.0936	1569.6809	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	273.4510	394.0755	318.0932	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	68.3627	98.5189	79.5233	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												246.4049 (107)
Energy for space heating												30.5569 (99)
Energy for space cooling												1.3814 (108)
Total												31.9383 (109)
Fabric Energy Efficiency (DFEE)												31.9 (109)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3397 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991 (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	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (25)

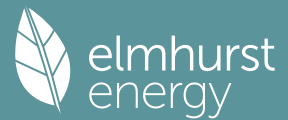
3. Heat losses and heat loss parameter

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						
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580			(27)					
Heatloss Floor 1			88.6200	0.1300	11.5206			(28a)					
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322			(29a)					
Render	98.3700	13.2000	85.1700	0.1800	15.3306			(29a)					
External Roof 1	89.7500		89.7500	0.1100	9.8725			(30)					
Total net area of external elements Aum(A, m2)			382.9800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.2139			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.7565	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				20.5100	0.0500	1.0255							
E3 Sill				11.8900	0.0500	0.5945							
E4 Jamb				32.7900	0.0500	1.6395							
E5 Ground floor (normal)				39.3500	0.1600	6.2960							
E6 Intermediate floor within a dwelling				41.2600	0.0000	0.0000							
E10 Eaves (insulation at ceiling level)				15.8900	0.0600	0.9534							
E12 Gable (insulation at ceiling level)				19.8400	0.0600	1.1904							
E13 Gable (insulation at rafter level)				6.2000	0.0800	0.4960							
E16 Corner (normal)				25.7100	0.0900	2.3139							
E17 Corner (inverted - internal area greater than external area)				5.1400	-0.0900	-0.4626							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0466	(36)					
Point Thermal bridges							0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		104.2605	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	87.3802	86.8442	86.3189	83.8513	83.3896	81.2404	81.2404	80.8424	82.0683	83.3896	84.3236	85.3000	(38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605	(39)
Average = Sum(39)m / 12 =												188.1096	
HLP	1.0744	1.0714	1.0684	1.0546	1.0520	1.0400	1.0400	1.0377	1.0446	1.0520	1.0573	1.0627	(40)
HLP (average)												1.0546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9737 (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	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713 (42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834 (42c)

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Average daily hot water use (litres/day)												70.6348 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547 (44)
Energy content (annual)	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924 (45)
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:												
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												
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 (57)
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 (59)
Total heat required for water heating calculated for each month												
WWHRS	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186 (62)
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 (63a)
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 (63b)
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 (63c)
Output from w/h	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)
12Total per year (kWh/year)	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186 (64)
Electric shower(s)	59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246 (64a)
Heat gains from water heating, kWh/month	40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												997 (64)

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	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Water heating gains (Table 5)	54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011	54.3492 (72)
Total internal gains	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445	635.9273 (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					14.4500	10.6334	0.6300		0.7000		0.7700	46.9582 (74)		
East					0.5000	19.6403	0.6300		0.7000		0.7700	3.0012 (76)		
South					18.2000	46.7521	0.6300		0.7000		0.7700	260.0423 (78)		
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)		
Total gains	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948	1496.9547	1407.0775	1325.7666	1154.0758	985.2544	902.2425 (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	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062	50.6440
alpha	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937	4.3763
util living area	0.9962	0.9899	0.9771	0.9395	0.8537	0.6920	0.5279	0.5779	0.8033	0.9572	0.9915	0.9971 (86)
MIT	19.3330	19.5910	19.9230	20.3509	20.7027	20.9183	20.9806	20.9713	20.8348	20.3672	19.7727	19.2968 (87)
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359	20.0314 (88)
util rest of house	0.9952	0.9873	0.9709	0.9223	0.8117	0.6122	0.4219	0.4707	0.7363	0.9416	0.9888	0.9964 (89)
MIT 2	18.4935	18.7516	19.0814	19.5048	19.8281	20.0073	20.0438	20.0418	19.9476	19.5285	18.9423	18.4645 (90)
Living area fraction	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (91)
MIT	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (92)
Temperature adjustment	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9931	0.9830	0.9638	0.9130	0.8066	0.6187	0.4348	0.4834	0.7373	0.9331	0.9850	0.9947 (94)
Ext temp.	955.1524	1174.4412	1298.6550	1367.1440	1273.0918	963.9179	650.9079	680.2006	977.5128	1076.8644	970.4435	897.4369 (95)
Heat loss rate W	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)
Space heating kWh	2740.3067	2667.3032	2417.9584	2014.9352	1545.9004	1024.3351	660.7147	695.7691	1110.3987	1695.2574	2252.9929	2723.8548 (97)
Space heating requirement - total per year (kWh/year)	1328.1548	1003.2033	832.7618	466.4097	202.9696	0.0000	0.0000	0.0000	0.0000	460.0843	923.4355	1358.8549 (98a)
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)

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Solar heating contribution - total per year (kWh/year) 0.0000
Space heating kWh
1328.1548 1003.2033 832.7618 466.4097 202.9696 0.0000 0.0000 0.0000 0.0000 460.0843 923.4355 1358.8549 (98c)
Space heating requirement after solar contribution - total per year (kWh/year) 6575.8739
Space heating per m2 (98c) / (4) = 36.8665 (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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1743.7088	1372.7069	1406.7823	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8154	0.8869	0.8585	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1421.8749	1217.3980	1207.7434	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh													
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	228.3857	337.5495	269.2815	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)									f _c = cooled area / (4) =			1.0000	(105)
Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	57.0964	84.3874	67.3204	0.0000	0.0000	0.0000	0.0000	(107)
Energy for space heating												208.8042	(107)
Energy for space cooling												36.8665	(99)
Total												1.1706	(108)
Fabric Energy Efficiency (TFEE)												38.0371	(109)
												38.0	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)	
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (5)	

2. Ventilation rate

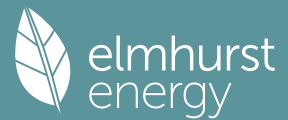
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0897 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2897	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2897 (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													
Effective ac	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404	(22b)
	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Glazing (U _w = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements A _{um} (A, m ²)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680			(33)
Heat capacity C _m = Sum (A x k)								(34)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							34560.3500	(34)
List of Thermal Bridges							193.7565	(35)

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K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	86.9555 (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	83.6161	83.2263	82.8442	81.0495	80.7138	79.1507	79.1507	78.8612	79.7528	80.7138	81.3930	82.1032	(38)
Heat transfer coeff	170.5716	170.1818	169.7997	168.0051	167.6693	166.1062	166.1062	165.8167	166.7083	167.6693	168.3486	169.0587	(39)
Average = Sum(39)m / 12 =												168.0035	
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478	(40)
HLP (average)												0.9419	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(65)

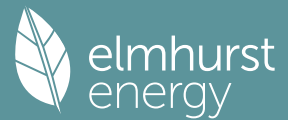
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(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					14.4500	10.6334	0.6300	0.7000	0.7700		46.9582 (74)	
East					0.5000	19.6403	0.6300	0.7000	0.7700		3.0012 (76)	
South					18.2000	46.7521	0.6300	0.7000	0.7700		260.0423 (78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1112.9346	1321.9384	1478.4875	1597.1898	1660.9682	1615.7024	1550.9474	1466.6057	1394.0865	1251.3818	1102.3931	1045.9866 (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	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251	56.7856	
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017	4.7857	
util living area	0.9930	0.9836	0.9630	0.9109	0.8009	0.6257	0.4647	0.5094	0.7407	0.9332	0.9856	0.9947 (86)	
MIT	19.9362	20.1099	20.3397	20.6034	20.8041	20.9061	20.9303	20.9273	20.8683	20.6045	20.2154	19.9023 (87)	
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304	20.1271 (88)	
util rest of house	0.9912	0.9797	0.9538	0.8890	0.7555	0.5531	0.3771	0.4194	0.6733	0.9121	0.9814	0.9933 (89)	
MIT 2	19.1410	19.3143	19.5409	19.7992	19.9778	20.0618	20.0753	20.0755	20.0350	19.8065	19.4272	19.1133 (90)	
Living area fraction									fLA = Living area / (4) =				0.1259 (91)
MIT	19.2411	19.4145	19.6414	19.9004	20.0818	20.1681	20.1830	20.1828	20.1399	19.9070	19.5265	19.2127 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.2411	19.4145	19.6414	19.9004	20.0818	20.1681	20.1830	20.1828	20.1399	19.9070	19.5265	19.2127 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9756	0.9478	0.8823	0.7525	0.5555	0.3815	0.4237	0.6734	0.9054	0.9776	0.9915 (94)
Useful gains	1100.6031	1289.7307	1401.2456	1409.1383	1249.8338	897.4623	591.6281	621.4174	938.7962	1133.0194	1077.7329	1037.0937 (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	2548.5280	2470.1047	2231.4126	1848.1302	1405.3734	924.8952	595.1543	627.2443	1006.9092	1560.4945	2091.9800	2538.0194 (97)
Space heating kWh	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98a)
Space heating requirement - total per year (kWh/year)												5084.8954
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	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5084.8954
Space heating per m2										(98c) / (4) =		28.5076 (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 %)													84.0000 (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	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98)	
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)	
Space heating fuel (main heating system)	1282.4478	944.2992	735.2908	376.2787	137.7636	0.0000	0.0000	0.0000	0.0000	378.6208	869.3546	1329.3913 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)	
Efficiency of water heater	88.4999	88.4242	88.2795	87.9880	87.4232	86.6000	86.6000	86.6000	86.6000	87.9878	88.3891	88.5187 (216)	
Fuel for water heating, kWh/month	311.7656	275.5172	292.0396	254.8335	246.7326	222.3592	217.9136	227.7111	231.4819	256.5099	274.5168	307.9276 (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	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-95.6263	-123.4667	-162.7327	-168.9607	-172.3835	-157.4893	-155.4666	-151.3021	-143.6692	-133.5540	-101.1240	-84.2697 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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													6053.4469 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													86.6000
Water heating fuel used													3119.3088 (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)													325.0287 (232)

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

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PV generation	-1650.0447	(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	7933.7396	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6053.4469	3.6400	220.3455 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3119.3088	3.6400	113.5428 (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	325.0287	16.4900	53.5972 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1650.0447	16.4900	-272.0924
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-272.0924 (252)
Total energy cost			221.5746 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3571 (257)
SAP value		94.2113
SAP rating (Section 12)		94 (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	6053.4469	0.2100	1271.2238 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3119.3088	0.2100	655.0548 (264)
Space and water heating			1926.2787 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1650.0447	0.1363	-224.9539
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-224.9539 (269)
Total CO2, kg/year			1760.1658 (272)
CO2 emissions per m2			9.8700 (273)
EI value			89.4407
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

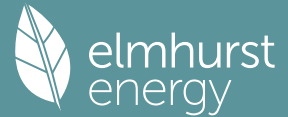
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (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) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50 4.0000 (17)
Infiltration rate 0.2897 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2897 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000
Adj infilt rate	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750
Effective ac	0.3694	0.3404	0.3332	0.3114	0.3114	0.2897	0.2897	0.2825	0.2897	0.3259	0.3187	0.3404
	0.5682	0.5579	0.5555	0.5485	0.5485	0.5420	0.5420	0.5399	0.5420	0.5531	0.5508	0.5579

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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	80.1680		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 86.9555 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	83.6161	82.1032	81.7442	80.7138	80.7138	79.7528	79.7528	79.4479	79.7528	81.3930	81.0495	82.1032
Average = Sum(39)m / 12 =	170.5716	169.0587	168.6998	167.6693	167.6693	166.7083	166.7083	166.4034	166.7083	168.3486	168.0051	169.0587
												167.9674

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9563	0.9478	0.9458	0.9400	0.9400	0.9346	0.9346	0.9329	0.9346	0.9438	0.9419	0.9478
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

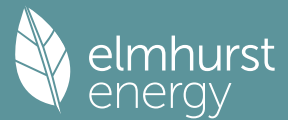
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths													
	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses													
	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)													138.9328 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy content (annual)	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Distribution loss (46)m = 0.15 x (45)m													
	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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)
													0.0000 (64a)
Heat gains from water heating, kWh/month	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(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
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(66)m	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(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					14.4500	13.8645		0.6300	0.7000	0.7700		61.2273 (74)	
East					0.5000	25.9136		0.6300	0.7000	0.7700		3.9598 (76)	
South					18.2000	58.2505		0.6300	0.7000	0.7700		323.9985 (78)	

Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426 (83)	
Total gains	1192.1185	1359.9608	1528.4733	1684.7122	1720.4991	1765.5442	1667.0751	1585.4210	1499.8927	1329.0833	1192.5580	1099.0141 (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	56.2819	56.7856	56.9064	57.2561	57.2561	57.5862	57.5862	57.6917	57.5862	57.0251	57.1417	56.7856		
alpha	4.7521	4.7857	4.7938	4.8171	4.8171	4.8391	4.8391	4.8461	4.8391	4.8017	4.8094	4.7857		
util living area	0.9877	0.9776	0.9487	0.8759	0.7363	0.5171	0.3681	0.3859	0.6324	0.8843	0.9713	0.9909	(86)	
MIT	20.0851	20.2138	20.4409	20.6851	20.8543	20.9241	20.9342	20.9339	20.9062	20.7210	20.3847	20.0563	(87)	
Th 2	20.1199	20.1271	20.1288	20.1336	20.1336	20.1382	20.1382	20.1396	20.1382	20.1304	20.1320	20.1271	(88)	
util rest of house	0.9845	0.9720	0.9360	0.8470	0.6814	0.4423	0.2834	0.2974	0.5542	0.8491	0.9627	0.9884	(89)	
MIT 2	19.2889	19.4212	19.6430	19.8743	20.0171	20.0690	20.0737	20.0752	20.0596	19.9086	19.5947	19.2666	(90)	
Living area fraction														
MIT	19.3891	19.5210	19.7434	19.9764	20.1225	20.1767	20.1821	20.1833	20.1662	20.0109	19.6942	19.3660	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.3891	19.5210	19.7434	19.9764	20.1225	20.1767	20.1821	20.1833	20.1662	20.0109	19.6942	19.3660	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9812	0.9672	0.9294	0.8411	0.6806	0.4457	0.2877	0.3020	0.5568	0.8435	0.9573	0.9857	(94)	
Useful gains	1169.6514	1315.3779	1420.4996	1417.0768	1171.0167	786.9491	479.6374	478.7704	835.1958	1121.0360	1141.6644	1083.2646	(95)	
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)	
Heat loss rate W	2386.1469	2336.5617	2099.2060	1739.8103	1261.2981	796.3136	480.4688	479.7921	861.2449	1382.2893	1897.4807	2344.1709	(97)	
Space heating kWh	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98a)	
Space heating requirement - total per year (kWh/year)												4072.4778		
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	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												4072.4778		
Space heating per m2										(98c) / (4) =		22.8316	(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 %)													84.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98)	
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)	
Space heating fuel (main heating system)	1077.4674	816.9470	601.1400	276.6287	79.9636	0.0000	0.0000	0.0000	0.0000	231.3958	647.8425	1116.8027	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(64)	
Efficiency of water heater	88.4275	88.3584	88.1741	87.8050	87.1581	86.6000	86.6000	86.6000	86.6000	87.6942	88.2458	88.4481	(216)	
Fuel for water heating, kWh/month	312.0210	275.7223	292.3889	255.3647	247.4829	222.3592	217.9136	227.7111	231.4819	257.3688	274.9624	308.1732	(219)	
Space cooling fuel requirement														

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(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	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926		(232)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-112.2554	-129.6983	-168.9566	-174.9159	-175.1038	-162.1692	-159.3160	-156.5213	-150.6084	-142.8879	-116.4430	-96.5140		(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													4848.1879	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													86.6000	
Water heating fuel used													3122.9501	(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)													325.0287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1745.3901	(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													6636.7766	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4848.1879	5.6000	271.4985	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3122.9501	5.6000	174.8852	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116	(249)
Energy for lighting	325.0287	26.0600	84.7025	(250)
Additional standing charges			99.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.3901	26.0600	-454.8486	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-454.8486	(252)
Total energy cost			197.6492	(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	4848.1879	0.2100	1018.1194	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3122.9501	0.2100	655.8195	(264)
Space and water heating			1673.9390	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.3901	0.1368	-238.8228	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-238.8228	(269)
Total CO2, kg/year			1493.9571	(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	4848.1879	1.1300	5478.4523	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3122.9501	1.1300	3528.9337	(278)
Space and water heating			9007.3859	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	325.0287	1.5338	498.5398	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.3901	1.5058	-2628.2152	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-2628.2152	(283)
Total Primary energy kWh/year			7007.8114	(286)

SAP 10 EPC IMPROVEMENTS

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00001

Current energy efficiency rating: A 94
Current environmental impact rating: B 89

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 -£ 34 -176 kg (11.8%)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 94
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 547 TEST (31 May 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£107	£107	£0
Mains gas	£545	£545	£0
Space heating	£393	£393	£0
Water heating	£175	£175	£0
Lighting	£85	£85	£0
Generated (PV)	-£455	-£455	£0
Total cost of fuels	£197	£197	£0
Total cost of uses	£198	£198	£0
Delivered energy	37 kWh/m²	37 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	39 kWh/m²	39 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)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (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)

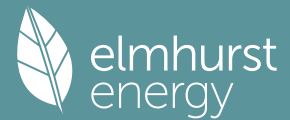
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0897 (8)

Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.0000 (17)
Infiltration rate 0.2897 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2897 (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	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404 (22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579 (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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	80.1680			(33)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717	
E3 Sill	11.8900	0.0200	0.2378	
E4 Jamb	32.7900	0.0160	0.5246	
E5 Ground floor (normal)	39.3500	0.0620	2.4397	
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413	
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646	
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912	
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480	
E16 Corner (normal)	25.7100	0.0400	1.0284	
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				6.7876 (36)
Point Thermal bridges				0.0000
Total fabric heat loss			(33) + (36) + (36a) =	86.9555 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	83.6161	83.2263	82.8442	81.0495	80.7138	79.1507	79.1507	78.8612	79.7528	80.7138	81.3930	82.1032	(38)
Average = Sum(39)m / 12 =	170.5716	170.1818	169.7997	168.0051	167.6693	166.1062	166.1062	165.8167	166.7083	167.6693	168.3486	169.0587	(39)
												168.0035	
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478	(40)
HLP (average)												0.9419	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

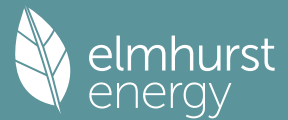
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947		(42a)
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713		(42b)
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834		(42c)
Average daily hot water use (litres/day)												138.9328	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m													
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056		(46)
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month													
275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734		(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(64)
								Total per year (kWh/year) = Sum(64)m =				2737.1231	(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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468		(71)
Water heating gains (Table 5)													
119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640		(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(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				14.4500	10.6334	0.6300	0.7000	0.7700	46.9582 (74)			
East				0.5000	19.6403	0.6300	0.7000	0.7700	3.0012 (76)			
South				18.2000	46.7521	0.6300	0.7000	0.7700	260.0423 (78)			
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1112.9346	1321.9384	1478.4875	1597.1898	1660.9682	1615.7024	1550.9474	1466.6057	1394.0865	1251.3818	1102.3931	1045.9866 (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	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251	56.7856
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017	4.7857
util living area	0.9930	0.9836	0.9630	0.9109	0.8009	0.6257	0.4647	0.5094	0.7407	0.9332	0.9856	0.9947 (86)
MIT	19.9362	20.1099	20.3397	20.6034	20.8041	20.9061	20.9303	20.9273	20.8683	20.6045	20.2154	19.9023 (87)
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304	20.1271 (88)
util rest of house	0.9912	0.9797	0.9538	0.8890	0.7555	0.5531	0.3771	0.4194	0.6733	0.9121	0.9814	0.9933 (89)
MIT 2	19.1410	19.3143	19.5409	19.7992	19.9778	20.0618	20.0753	20.0755	20.0350	19.8065	19.4272	19.1133 (90)
Living area fraction									fLA = Living area / (4) =			0.1259 (91)
MIT	19.2411	19.4145	19.6414	19.9004	20.0818	20.1681	20.1830	20.1828	20.1399	19.9070	19.5265	19.2127 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2411	19.4145	19.6414	19.9004	20.0818	20.1681	20.1830	20.1828	20.1399	19.9070	19.5265	19.2127 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9889	0.9756	0.9478	0.8823	0.7525	0.5555	0.3815	0.4237	0.6734	0.9054	0.9776	0.9915 (94)
Useful gains	1100.6031	1289.7307	1401.2456	1409.1383	1249.8338	897.4623	591.6281	621.4174	938.7962	1133.0194	1077.7329	1037.0937 (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	2548.5280	2470.1047	2231.4126	1848.1302	1405.3734	924.8952	595.1543	627.2443	1006.9092	1560.4945	2091.9800	2538.0194 (97)
Space heating kWh	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98a)
Space heating requirement - total per year (kWh/year)												5084.8954
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	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5084.8954
Space heating per m2										(98c) / (4) =		28.5076 (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 %)												84.0000 (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	1077.2562	793.2113	617.6443	316.0741	115.7214	0.0000	0.0000	0.0000	0.0000	318.0414	730.2579	1116.6887 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	1282.4478	944.2992	735.2908	376.2787	137.7636	0.0000	0.0000	0.0000	0.0000	378.6208	869.3546	1329.3913 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
Efficiency of water heater (217)m	88.4999	88.4242	88.2795	87.9880	87.4232	86.6000	86.6000	86.6000	86.6000	87.9878	88.3891	88.5187 (216)
Fuel for water heating, kWh/month	311.7656	275.5172	292.0396	254.8335	246.7326	222.3592	217.9136	227.7111	231.4819	256.5099	274.5168	307.9276 (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	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-95.6263	-123.4667	-162.7327	-168.9607	-172.3835	-157.4893	-155.4666	-151.3021	-143.6692	-133.5540	-101.1240	-84.2697 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)												

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(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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													6053.4469	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													86.6000	
Water heating fuel used													3119.3088	(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)													325.0287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1650.0447	(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													7933.7396	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6053.4469	3.6400	220.3455	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3119.3088	3.6400	113.5428	(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	325.0287	16.4900	53.5972	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1650.0447	16.4900	-272.0924	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-272.0924	(252)
Total energy cost			221.5746	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.3571	(257)
SAP value		94.2113	
SAP rating (Section 12)		94	(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	6053.4469	0.2100	1271.2238	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3119.3088	0.2100	655.0548	(264)
Space and water heating			1926.2787	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1650.0447	0.1363	-224.9539	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-224.9539	(269)
Total CO2, kg/year			1760.1658	(272)
CO2 emissions per m2			9.8700	(273)
EI value			89.4407	
EI rating			89	(274)
EI band			B	

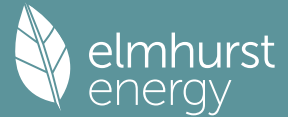
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)	
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	178.3700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 445.9250 (5)	

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)					

Infiltration due to chimneys, flues and fans	=	(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	=	40.0000	/	(5)	=	0.0897	(8)
Pressure test								Yes	
Pressure Test Method								Blower Door	
Measured/design AP50								4.0000	(17)
Infiltration rate								0.2897	(18)
Number of sides sheltered								0	(19)
Shelter factor	(20)	=	1	-	[0.075 x (19)]	=	1.0000	(20)	
Infiltration rate adjusted to include shelter factor	(21)	=	(18) x (20)	=	0.2897	(21)			

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate													
Effective ac	0.3694	0.3404	0.3332	0.3114	0.3114	0.2897	0.2897	0.2825	0.2897	0.3259	0.3187	0.3404	(22b)
	0.5682	0.5579	0.5555	0.5485	0.5485	0.5420	0.5420	0.5399	0.5420	0.5531	0.5508	0.5579	(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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	80.1680		(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	34560.3500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		193.7565	(35)

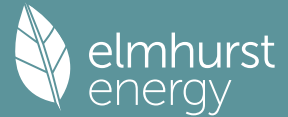
List of Thermal Bridges													
K1 Element						Length	Psi-value	Total					
E2 Other lintels (including other steel lintels)						20.5100	0.0230	0.4717					
E3 Sill						11.8900	0.0200	0.2378					
E4 Jamb						32.7900	0.0160	0.5246					
E5 Ground floor (normal)						39.3500	0.0620	2.4397					
E6 Intermediate floor within a dwelling						41.2600	0.0010	0.0413					
E10 Eaves (insulation at ceiling level)						15.8900	0.0670	1.0646					
E12 Gable (insulation at ceiling level)						19.8400	0.0550	1.0912					
E13 Gable (insulation at rafter level)						6.2000	0.0400	0.2480					
E16 Corner (normal)						25.7100	0.0400	1.0284					
E17 Corner (inverted - internal area greater than external area)						5.1400	-0.0700	-0.3598					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												6.7876	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	86.9555 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	83.6161	82.1032	81.7442	80.7138	80.7138	79.7528	79.7528	79.4479	79.7528	81.3930	81.0495	82.1032	(38)
Heat transfer coeff	170.5716	169.0587	168.6998	167.6693	167.6693	166.7083	166.7083	166.4034	166.7083	168.3486	168.0051	169.0587	(39)
Average = Sum(39)m / 12 =												167.9674	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9563	0.9478	0.9458	0.9400	0.9400	0.9346	0.9346	0.9329	0.9346	0.9438	0.9419	0.9478	(40)
HLP (average)												0.9417	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths													
	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses													
	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m													
	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month													
	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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)

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Output from w/h	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
	Total per year (kWh/year) = Sum(64)m = 2737.1231 (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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164 (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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W	
North					14.4500	13.8645		0.6300	0.7000		0.7700		61.2273 (74)	
East					0.5000	25.9136		0.6300	0.7000		0.7700		3.9598 (76)	
South					18.2000	58.2505		0.6300	0.7000		0.7700		323.9985 (78)	
Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426	(83)	
Total gains	1192.1185	1359.9608	1528.4733	1684.7122	1720.4991	1765.5442	1667.0751	1585.4210	1499.8927	1329.0833	1192.5580	1099.0141	(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	56.2819	56.7856	56.9064	57.2561	57.2561	57.5862	57.5862	57.6917	57.5862	57.0251	57.1417	56.7856
alpha	4.7521	4.7857	4.7938	4.8171	4.8171	4.8391	4.8391	4.8461	4.8391	4.8017	4.8094	4.7857
util living area	0.9877	0.9776	0.9487	0.8759	0.7363	0.5171	0.3681	0.3859	0.6324	0.8843	0.9713	0.9909 (86)
MIT	20.0851	20.2138	20.4409	20.6851	20.8543	20.9241	20.9342	20.9339	20.9062	20.7210	20.3847	20.0563 (87)
Th 2	20.1199	20.1271	20.1288	20.1336	20.1336	20.1382	20.1382	20.1396	20.1382	20.1304	20.1320	20.1271 (88)
util rest of house	0.9845	0.9720	0.9360	0.8470	0.6814	0.4423	0.2834	0.2974	0.5542	0.8491	0.9627	0.9884 (89)
MIT 2	19.2889	19.4212	19.6430	19.8743	20.0171	20.0690	20.0737	20.0752	20.0596	19.9086	19.5947	19.2666 (90)
Living area fraction	19.3891	19.5210	19.7434	19.9764	20.1225	20.1767	20.1821	20.1833	20.1662	20.0109	19.6942	19.3660 (91)
MIT	19.3891	19.5210	19.7434	19.9764	20.1225	20.1767	20.1821	20.1833	20.1662	20.0109	19.6942	19.3660 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3891	19.5210	19.7434	19.9764	20.1225	20.1767	20.1821	20.1833	20.1662	20.0109	19.6942	19.3660 (93)

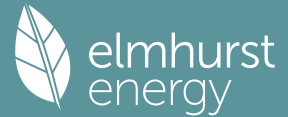
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9812	0.9672	0.9294	0.8411	0.6806	0.4457	0.2877	0.3020	0.5568	0.8435	0.9573	0.9857	(94)
Useful gains	1169.6514	1315.3779	1420.4996	1417.0768	1171.0167	786.9491	479.6374	478.7704	835.1958	1121.0360	1141.6644	1083.2646	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	2386.1469	2336.5617	2099.2060	1739.8103	1261.2981	796.3136	480.4688	479.7921	861.2449	1382.2893	1897.4807	2344.1709	(97)
Space heating kWh	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98a)
Space heating requirement - total per year (kWh/year)												4072.4778	
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	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4072.4778	
Space heating per m2												(98c) / (4) =	22.8316 (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 %)												84.0000 (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	905.0726	686.2355	504.9576	232.3681	67.1694	0.0000	0.0000	0.0000	0.0000	194.3725	544.1877	938.1143	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)													

Full SAP Calculation Printout



1077.4674	816.9470	601.1400	276.6287	79.9636	0.0000	0.0000	0.0000	0.0000	231.3958	647.8425	1116.8027	(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 requirement												
275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(64)
Efficiency of water heater (217)m												
88.4275	88.3584	88.1741	87.8050	87.1581	86.6000	86.6000	86.6000	86.6000	87.6942	88.2458	86.6000	(216)
Fuel for water heating, kWh/month												
312.0210	275.7223	292.3889	255.3647	247.4829	222.3592	217.9136	227.7111	231.4819	257.3688	274.9624	308.1732	(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	(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												
40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-112.2554	-129.6983	-168.9566	-174.9159	-175.1038	-162.1692	-159.3160	-156.5213	-150.6084	-142.8879	-116.4430	(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	(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	(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	(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	(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	(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	(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											4848.1879	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											86.6000	(216)
Water heating fuel used											3122.9501	(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)											325.0287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1745.3901	(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											6636.7766	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4848.1879	5.6000	271.4985	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3122.9501	5.6000	174.8852	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116	(249)
Energy for lighting	325.0287	26.0600	84.7025	(250)
Additional standing charges			99.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.3901	26.0600	-454.8486	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-454.8486	(252)
Total energy cost			197.6492	(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	4848.1879	0.2100	1018.1194	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3122.9501	0.2100	655.8195	(264)
Space and water heating			1673.9390	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.3901	0.1368	-238.8228	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-238.8228	(269)
Total CO2, kg/year			1493.9571	(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	4848.1879	1.1300	5478.4523	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3122.9501	1.1300	3528.9337	(278)
Space and water heating			9007.3859	(279)

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Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1745.3901	1.5058	-2628.2152
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2628.2152 (283)
Total Primary energy kWh/year			7007.8114 (286)

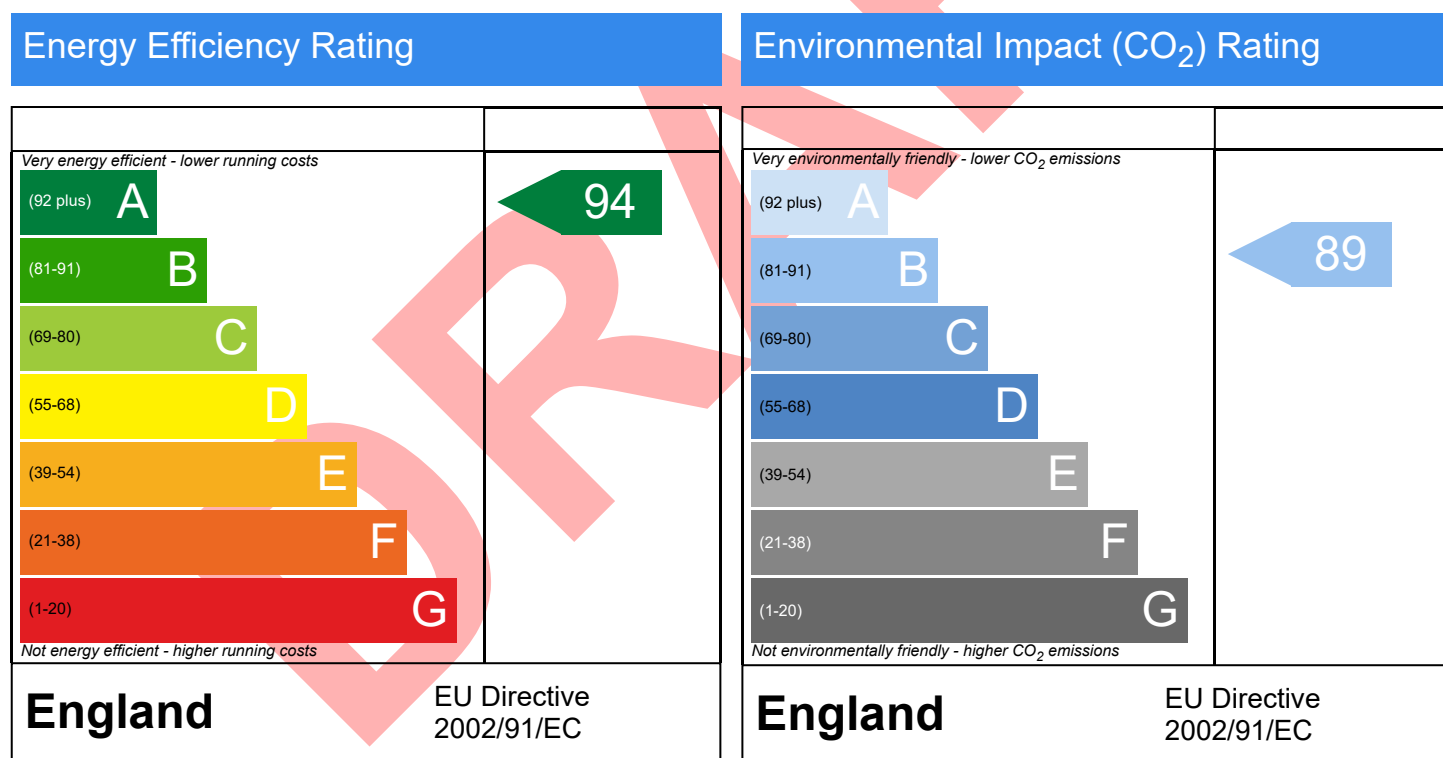
Predicted Energy Assessment



Dwelling type: House, Detached
Date of assessment: 25/06/2024
Produced by: James Gradwell
Total floor area: 178.37 m²
DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data



Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Paul Giesberg	
Property				

SAP Rating	94 A	DER	10.23	TER	8.49
Environmental	89 B	% DER < TER			-20.49
CO ₂ Emissions (t/year)	1.49	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	-11.65	DPER	49.69	TPER	44.50

Assessor Details	Mr. James Gradwell			Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg				

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenture	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	39.35 m	88.62 m ²	2.50 m
		41.26 m	89.75 m ²	2.50 m

8.0 Living Area	22.46	m ²
-----------------	-------	----------------

9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Brickwork	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	106.24	86.29	0.00	None	19.95	Enter Gross Area
	Render	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	98.37	85.17	0.00	None	13.20	Enter Gross Area

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	89.75	89.75	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
	Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	88.62

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
	Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.90

13.0 Openings	Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
	NORTH	Glazing	Brickwork	North	6.55	
	NORTH RENDER	Glazing	Render	North	7.90	
	SOUTH	Glazing	Brickwork	South	13.40	
	SOUTH RENDER	Glazing	Render	South	4.80	
	EAST	Glazing	Render	East	0.50	

Summary for Input Data

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	20.51	0.02	0.02 RCD	No
E3 Sill	Non Gov Approved Schemes	11.89	0.02	0.02 RCD	No
E4 Jamb	Non Gov Approved Schemes	32.79	0.02	0.02 RCD	No
E5 Ground floor (normal)	Non Gov Approved Schemes	39.35	0.06	0.06 RCD	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	41.26	0.00	0.00 RCD	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	15.89	0.07	0.07 RCD	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	19.84	0.06	0.06 RCD	No
E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	6.20	0.04	0.04 RCD	No
E16 Corner (normal)	Non Gov Approved Schemes	25.71	0.04	0.04 RCD	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	5.14	-0.07	-0.07 RCD	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5	400	40

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Delayed Start Stat

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heating Pump Age

Heat Emitter

Underfloor Heating

Flow Temperature

Flow Temperature Value

Boiler Interlock

Combi boiler type

Combi keep hot type

Summary for Input Data



25.0 Main Heating 2

26.0 Heat Networks

28.0 Water Heating

Water Heating

SAP Code

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

Cold Water Source

Bath Count

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
-------------	-------------	-------------------	------------------	-----------	--------------

28.3 Waste Water Heat Recovery System Instantaneous System 1

Database ID

Brand Model

Details

29.0 Hot Water Cylinder

In Airing Cupboard

32.0 Photovoltaic Unit

Export Capable Meter?

Connected To Dwelling

Diverter

Battery Capacity [kWh]

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
6.50	South	45°	None Or Little		No	1.00		

34.0 Small-scale Hydro

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

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement
		SAP rating Environmental Impact
		A 95 B 90
		0 0
		0 0

Thermal Bridging

Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Detached House	
Property				

SAP Rating	94 A	DER	10.23	TER	8.49
Environmental	89 B	% DER < TER			-20.49
CO ₂ Emissions (t/year)	1.49	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	-11.65	DPER	49.69	TPER	44.50

Assessor Details	Mr. James Gradwell	Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	0.023	20.51	0.47	RCD
External wall	E3 Sill	Non Gov Approved Schemes	0.020	11.89	0.24	RCD
External wall	E4 Jamb	Non Gov Approved Schemes	0.016	32.79	0.52	RCD
External wall	E5 Ground floor (normal)	Non Gov Approved Schemes	0.062	39.35	2.44	RCD
External wall	E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	0.001	41.26	0.04	RCD
External wall	E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	0.067	15.89	1.06	RCD
External wall	E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	0.055	19.84	1.09	RCD
External wall	E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	0.040	6.20	0.25	RCD
External wall	E16 Corner (normal)	Non Gov Approved Schemes	0.040	25.71	1.03	RCD
External wall	E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	-0.070	5.14	-0.36	RCD

Total: 218.58 W/mK:
Y-Value: 0.02 W/m²K:

Overview Report

Dwelling Address	
Report Date	25/06/2024
Property Type	House, Detached
Floor Area [m ²]	178

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL

(92 plus)

A

94

94

(81-91)

B

(69-80)

C

(55-68)

D

(39-54)

E

(21-38)

F

(1-20)

G

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good
-----------	------	---------	------	-----------

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.12 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Programmer, room thermostat and TRVs	Good
Secondary heating	None	
Hot water	From main system, waste water heat recovery	Very Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 4.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 39 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.5** per year

Overview Report

With the recommended measures the potential CO emissions could be: **0.0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating		 1	£34	 A 95
Photovoltaic		 -95	£231	 G 0

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£198

Over a year you could save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Overview Report

Assessor contact details

Assessor name	Mr. James Gradwell
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	25/06/2024
Date of certificate	25/06/2024
Type of assessment	SAP, new dwelling

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 25 Jun 2024 21:51:31

Project Information			
Assessed By	James Gradwell	Building Type	House, Detached
OCDEA Registration	EES/028346	Assessment Date	2024-06-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	178 m ²
Site Reference	Paul Giesberg	Plot Reference	00001
Address			

Client Details	
Name	Paul Giesberg
Company	Planning for sustainability
Address	164 Harefield Road , Uxbridge , UB8 1PP

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	8.49 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	8.04 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	44.5 kWh _{PE} /m ²		
Dwelling primary energy	39.83 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	38.0 kWh/m ²		
Dwelling fabric energy efficiency	31.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	0.9	NORTH (0.9)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	86.29	0.18	
Exposed wall: Walls (2)	85.17	0.18	
Ground floor: Heatloss Floor 1, Heatloss Floor 1	88.62	0.12	
Exposed roof: Roof (1)	89.75	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
NORTH, Glazing	6.55	North	0.7	0.9 (!)
NORTH RENDER , Glazing	7.9	North	0.7	0.9 (!)
SOUTH , Glazing	13.4	South	0.7	0.9 (!)
SOUTH RENDER , Glazing	4.8	South	0.7	0.9 (!)
EAST, Glazing	0.5	East	0.7	0.9 (!)

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.023 (!)	RCD

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.02 (!)	RCD
External wall	E4: Jamb	Not government-approved scheme	0.016 (!)	RCD
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.062	RCD
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0.001 (!)	RCD
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.067	RCD
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.055	RCD
External wall	E13: Gable (insulation at rafter level)	Not government-approved scheme	0.04	RCD
External wall	E16: Corner (normal)	Not government-approved scheme	0.04	RCD
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.07	RCD

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Boiler with radiators or underfloor heating - Mains gas

Efficiency	84.0%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Combi boiler
Manufacturer	Bosch Thermotechnology
Model	Greenstar
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: N/A

Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: Instantaneous

Efficiency	0.0%
Manufacturer	Building Products Distributors Ltd
Model	Showersave QB1-21 Cyclone

6 Controls

Main heating 1 - type: Programmer, room thermostat, and TRVs

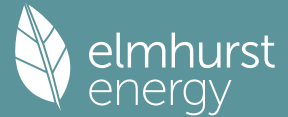
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.76 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	88%	OK
Manufacturer/Model	MRXBOXAB-ECO3, MRXBOXAB-ECO3C	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	6.5 kWp	
Orientation	South	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Paul Giesberg				Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref		Paul Giesberg		
Property						
SAP Rating	94 A	DER	8.04	TER	8.49	
Environmental	92 A	% DER < TER				5.30
CO ₂ Emissions (t/year)	1.16	DFEE	31.94	TFEE	38.04	
Compliance Check	See BREL	% DFEE < TFEE				16.03
% DPER < TPER	10.50	DPER	39.83	TPER	44.50	
Assessor Details	Mr. James Gradwell				Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg					

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

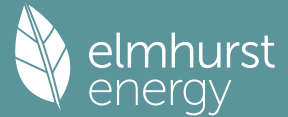
2. Ventilation rate

	m ³ 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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 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	0.2550 0.2500 0.2450 0.2200 0.2150 0.1900 0.1900 0.1850 0.2000 0.2150 0.2250 0.2350 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)
Effective ac	0.3590 0.3540 0.3490 0.3240 0.3190 0.2940 0.2940 0.2890 0.3040 0.3190 0.3290 0.3390 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983		(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000 (28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000 (29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000 (29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500 (30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.7565 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				20.5100	0.0230	0.4717	
E3 Sill				11.8900	0.0200	0.2378	

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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	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770
util living area	0.9943	0.9823	0.9551	0.8723	0.7200	0.5153	0.3722	0.4099	0.6418	0.9069	0.9846	0.9958 (86)
MIT	20.1604	20.3455	20.5494	20.7795	20.9014	20.9424	20.9469	20.9467	20.9293	20.7654	20.4324	20.1442 (87)
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819 (88)
util rest of house	0.9929	0.9782	0.9451	0.8475	0.6768	0.4621	0.3145	0.3497	0.5846	0.8827	0.9804	0.9948 (89)
MIT 2	19.4881	19.6741	19.8757	20.1063	20.2122	20.2593	20.2617	20.2654	20.2442	20.1008	19.7766	19.4844 (90)
Living area fraction									fLA = Living area / (4) =			0.1259 (91)
MIT	19.5728	19.7587	19.9605	20.1911	20.2990	20.3453	20.3480	20.3512	20.3305	20.1845	19.8592	19.5674 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5728	19.7587	19.9605	20.1911	20.2990	20.3453	20.3480	20.3512	20.3305	20.1845	19.8592	19.5674 (93)

8. Space heating requirement

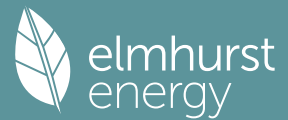
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9912	0.9748	0.9401	0.8436	0.6770	0.4645	0.3174	0.3526	0.5866	0.8783	0.9773	0.9934 (94)
Useful gains	1017.2498	1226.1465	1322.9931	1307.3351	1100.7947	743.6967	487.6781	510.9276	803.6926	1057.3633	1018.6581	959.3264 (95)
Ext temp.	4.3000	4.9000	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	2134.8930	2066.0729	1861.7627	1520.1584	1151.3891	748.1480	488.0553	511.6090	820.4990	1283.3482	1727.2081	2102.8990 (97)
Space heating kWh	831.5265	564.4305	400.8445	153.2328	37.6422	0.0000	0.0000	0.0000	0.0000	168.1327	510.1560	850.8181 (98a)
Space heating requirement - total per year (kWh/year)												3516.7833
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	831.5265	564.4305	400.8445	153.2328	37.6422	0.0000	0.0000	0.0000	0.0000	168.1327	510.1560	850.8181 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3516.7833
Space heating per m2										(98c) / (4) =		19.7162 (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 %)													84.0000 (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	831.5265	564.4305	400.8445	153.2328	37.6422	0.0000	0.0000	0.0000	0.0000	168.1327	510.1560	850.8181 (98)	
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)	
Space heating fuel (main heating system)	989.9125	671.9410	477.1959	182.4200	44.8122	0.0000	0.0000	0.0000	0.0000	200.1580	607.3286	1012.8786 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)	
Efficiency of water heater (217)m	88.3897	88.2625	88.0449	87.5585	86.9484	86.6000	86.6000	86.6000	86.6000	87.6086	88.2120	86.6000 (216)	
Fuel for water heating, kWh/month	312.1543	276.0219	292.8178	256.0836	248.0798	222.3592	217.9136	227.7111	231.4819	257.6203	275.0678	308.3217 (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	56.4664	51.0019	56.4664	54.6449	56.4664	54.6449	56.4664	56.4664	54.6449	56.4664	54.6449	56.4664 (231)	
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-98.8185	-129.0481	-172.2243	-181.5623	-188.1262	-173.6718	-172.2287	-166.6388	-156.0410	-142.0084	-105.4596	-86.9854 (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													4186.6468 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													86.6000
Water heating fuel used													3125.6332 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)													
mechanical ventilation fans (SFP = 1.0640)													578.8463 (230a)
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													664.8463 (231)
Electricity for lighting (calculated in Appendix L)													325.0287 (232)

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

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PV generation	-1772.8130	(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	6529.3419	(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	4186.6468	0.2100	879.1958 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3125.6332	0.2100	656.3830 (264)
Space and water heating			1535.5788 (265)
Pumps, fans and electric keep-hot	664.8463	0.1387	92.2224 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1772.8130	0.1359	-240.9762
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-240.9762 (269)
Total CO2, kg/year			1433.7366 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.0400 (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	4186.6468	1.1300	4730.9108 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3125.6332	1.1300	3531.9655 (278)
Space and water heating			8262.8763 (279)
Pumps, fans and electric keep-hot	664.8463	1.5128	1005.7795 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1772.8130	1.5024	-2663.5413
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2663.5413 (283)
Total Primary energy kWh/year			7103.6544 (286)
Dwelling Primary energy Rate (DPER)			39.8300 (287)

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

1. Overall dwelling characteristics

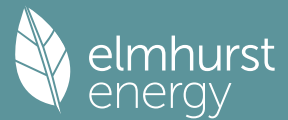
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3397 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (25)

Full SAP Calculation Printout



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	
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580			(27)
Heatloss Floor 1			88.6200	0.1300	11.5206			(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322			(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306			(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725			(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		90.2139			(33)

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

193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	20.5100	0.0500	1.0255	
E3 Sill	11.8900	0.0500	0.5945	
E4 Jamb	32.7900	0.0500	1.6395	
E5 Ground floor (normal)	39.3500	0.1600	6.2960	
E6 Intermediate floor within a dwelling	41.2600	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	15.8900	0.0600	0.9534	
E12 Gable (insulation at ceiling level)	19.8400	0.0600	1.1904	
E13 Gable (insulation at rafter level)	6.2000	0.0800	0.4960	
E16 Corner (normal)	25.7100	0.0900	2.3139	
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0900	-0.4626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				14.0466 (36)
Point Thermal Bridges				0.0000
Total fabric heat loss			(33) + (36) + (36a) =	104.2605 (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	87.3802	86.8442	86.3189	83.8513	83.3896	81.2404	81.2404	80.8424	82.0683	83.3896	84.3236	85.3000	(38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605	(39)
Average = Sum(39)m / 12 =												188.1096	
HLP	1.0744	1.0714	1.0684	1.0546	1.0520	1.0400	1.0400	1.0377	1.0446	1.0520	1.0573	1.0627	(40)
HLP (average)												1.0546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

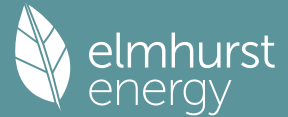
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)	
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)	
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)	
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use													
151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)	
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m													
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)	
Water storage 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	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	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													
290.3298	256.6546	272.2559	238.2396	230.2092	206.6271	203.2614	211.7333	214.5155	240.1903	256.6319	286.9960	(62)	
WWHRS	-33.8656	-29.9510	-31.3630	-25.9698	-24.2029	-20.7106	-19.4129	-20.6437	-21.4280	-25.2612	-28.6179	-33.2385	(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	256.4642	226.7036	240.8929	212.2698	206.0062	185.9165	183.8485	191.0897	193.0875	214.9291	228.0139	253.7575	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2592.9794	(64)
Electric shower(s)												2593	(64)
0.0000	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													
92.3306	81.5404	86.3210	75.1462	72.3404	64.6350	63.3803	66.1972	67.2579	75.6592	81.2616	91.2221	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	(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)													
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)													
124.1002	121.3399	116.0228	104.3697	97.2318	89.7709	85.1886	88.9748	93.4138	101.6924	112.8633	122.6103	(72)	
Total internal gains	724.1210	744.2163	710.5233	685.3672	647.6538	620.0582	594.0525	594.2069	613.7787	638.5603	680.3067	707.1885	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North				14.4500	10.6334		0.6300		0.7000	0.7700	46.9582 (74)
East				0.5000	19.6403		0.6300		0.7000	0.7700	3.0012 (76)
South				18.2000	46.7521		0.6300		0.7000	0.7700	260.0423 (78)
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	266.3152 (83)
Total gains	1034.1226	1265.7091	1415.1797	1557.5464	1633.8187	1605.8569	1541.4536	1453.7520	1375.0691	1211.7039	973.5036 (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
tau	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062
alpha	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937
util living area	0.9950	0.9875	0.9728	0.9318	0.8410	0.6770	0.5143	0.5621	0.7876	0.9499	0.9891
MIT	19.3856	19.6409	19.9677	20.3840	20.7227	20.9251	20.9825	20.9742	20.8483	20.4018	19.8189
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359
util rest of house	0.9936	0.9843	0.9656	0.9129	0.7972	0.5972	0.4103	0.4567	0.7188	0.9321	0.9858
MIT 2	18.1278	18.4544	18.8694	19.3929	19.7885	20.0002	20.0429	20.0404	19.9315	19.4246	18.6911
Living area fraction	18.2862	18.6038	19.0077	19.5177	19.9061	20.1167	20.1612	20.1580	20.0469	19.5477	18.8332
MIT	18.2862	18.6038	19.0077	19.5177	19.9061	20.1167	20.1612	20.1580	20.0469	19.5477	18.8332
Temperature adjustment											0.0000
adjusted MIT	18.2862	18.6038	19.0077	19.5177	19.9061	20.1167	20.1612	20.1580	20.0469	19.5477	18.8332

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9901	0.9777	0.9554	0.9003	0.7903	0.6032	0.4229	0.4690	0.7189	0.9203	0.9798	0.9922 (94)
Useful gains	1023.8748	1237.4455	1352.0539	1402.2831	1291.1497	968.6764	651.8235	681.7889	988.4893	1115.1681	1028.9540	965.9123 (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	2680.3204	2618.8670	2383.7167	1997.3075	1539.8838	1023.3472	660.6061	695.6083	1108.0856	1679.0347	2212.6860	2662.6388 (97)
Space heating	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (98a)
Space heating requirement - total per year (kWh/year)												6075.9120
Solar heating	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	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6075.9120
Space heating per m2										(98c) / (4) =		34.0635 (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	1232.3956	928.3152	767.5572	428.4175	185.0582	0.0000	0.0000	0.0000	0.0000	419.5167	852.2870	1262.3645 (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)	1333.7614	1004.6702	830.6896	463.6554	200.2794	0.0000	0.0000	0.0000	0.0000	454.0225	922.3885	1366.1954 (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	256.4642	226.7036	240.8929	212.2698	206.0062	185.9165	183.8485	191.0897	193.0875	214.9291	228.0139	253.7575 (64)
Efficiency of water heater	87.2897	87.0697	86.6824	85.8536	84.1523	80.3000	80.3000	80.3000	80.3000	85.7875	86.9349	87.3345 (216)
Fuel for water heating, kWh/month	293.8082	260.3702	277.9029	247.2462	244.8016	231.5274	228.9520	237.9697	240.4577	250.5366	262.2814	290.5582 (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	37.2806	29.9079	26.9287	19.7291	15.2393	12.4507	13.9018	18.0701	23.4713	30.7956	34.7836	38.3167 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-75.4014	-102.6818	-142.5704	-154.5687	-161.8547	-149.1948	-147.1295	-141.0701	-129.9310	-114.4155	-81.5024	-65.6023 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-54.3557	-112.7574	-221.3379	-328.5901	-430.9550	-431.9160	-427.0296	-363.3355	-268.5563	-160.1892	-72.1962	-43.1238 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)

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

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

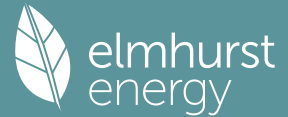
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

2 Ventilation rate

SAP 10 Online 2.13.6

Full SAP Calculation Printout



Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2897 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2897 (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	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404	(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	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579	(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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.1680			(33)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 34560.3500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

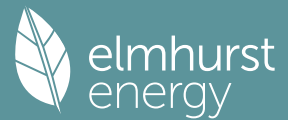
List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	20.5100	0.0230	0.4717	
E2 Other lintels (including other steel lintels)	11.8900	0.0200	0.2378	
E3 Sill	32.7900	0.0160	0.5246	
E4 Jamb	39.3500	0.0620	2.4397	
E5 Ground floor (normal)	41.2600	0.0010	0.0413	
E6 Intermediate floor within a dwelling	15.8900	0.0670	1.0646	
E10 Eaves (insulation at ceiling level)	19.8400	0.0550	1.0912	
E12 Gable (insulation at ceiling level)	6.2000	0.0400	0.2480	
E13 Gable (insulation at rafter level)	25.7100	0.0400	1.0284	
E16 Corner (normal)	5.1400	-0.0700	-0.3598	
E17 Corner (inverted - internal area greater than external area)			6.7876	(36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			0.0000	(36a) =
Point Thermal bridges				
Total fabric heat loss				(33) + (36) + (36a) = 86.9555 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	83.6161	83.2263	82.8442	81.0495	80.7138	79.1507	79.1507	78.8612	79.7528	80.7138	81.3930	82.1032	(38)
Heat transfer coeff	170.5716	170.1818	169.7997	168.0051	167.6693	166.1062	166.1062	165.8167	166.7083	167.6693	168.3486	169.0587	(39)
Average = Sum(39)m / 12 =												168.0035	
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478	(40)
HLP (average)												0.9419	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (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	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												70.6348	(43)
Daily hot water use	77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547	(44)
Energy conte	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924	(45)
Energy content (annual)										Total = Sum(45)m =		1173.0939	
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:													
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	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186	(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	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				997.1298	(64)
Electric shower(s)	59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246	(64a)
Heat gains from water heating, kWh/month	40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358	(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	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Water heating gains (Table 5)	54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011	54.3492 (72)
Total internal gains	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445	635.9273 (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	14.4500				10.6334		0.6300		0.7000		0.7700		46.9582 (74)	
East	0.5000				19.6403		0.6300		0.7000		0.7700		3.0012 (76)	
South	18.2000				46.7521		0.6300		0.7000		0.7700		260.0423 (78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152	(83)	
Total gains	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948	1496.9547	1407.0775	1325.7666	1154.0758	985.2544	902.2425	(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	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251	56.7856
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017	4.7857
util living area	0.9962	0.9891	0.9736	0.9271	0.8231	0.6443	0.4804	0.5291	0.7651	0.9491	0.9908	0.9972 (86)
MIT	19.5562	19.8093	20.1207	20.5061	20.8004	20.9546	20.9910	20.9859	20.8957	20.5029	19.9554	19.5150 (87)
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304	20.1271 (88)
util rest of house	0.9952	0.9863	0.9668	0.9081	0.7797	0.5710	0.3903	0.4364	0.6990	0.9319	0.9881	0.9964 (89)
MIT 2	18.7900	19.0427	19.3510	19.7281	19.9929	20.1175	20.1381	20.1374	20.0768	19.7326	19.1958	18.7545 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (92)
Temperature adjustment												
adjusted MIT	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915	18.8503 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9933	0.9822	0.9602	0.9002	0.7775	0.5784	0.4015	0.4477	0.7025	0.9244	0.9844	0.9949 (94)
Useful gains	955.3420	1173.5192	1293.7529	1348.1001	1227.1297	901.1285	601.0507	629.9280	931.3379	1066.8272	969.9318	897.6607 (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	2488.0439	2423.2642	2198.5471	1835.6324	1407.5178	933.9917	605.5342	637.4347	1013.5745	1547.5234	2052.4144	2476.7531 (97)
Space heating kWh	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875	1174.8447 (98a)
Space heating requirement - total per year (kWh/year)	5450.4278											
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	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875	1174.8447 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5450.4278											
Space heating per m ²	(98c) / (4) = 30.5569 (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	1561.3983	1229.1859	1260.2073	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8706	0.9286	0.9063	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1359.2843	1141.4221	1142.1362	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1739.0773	1671.0936	1569.6809	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	273.4510	394.0755	318.0932	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
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 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.3627	98.5189	79.5233	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	246.4049 (107)											
Energy for space heating	30.5569 (99)											
Energy for space cooling	1.3814 (108)											
Total	31.9383 (109)											
Fabric Energy Efficiency (DFEE)	31.9 (109)											

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (5)

2. Ventilation rate

	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3397 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991 (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	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580		(27)
Heatloss Floor 1			88.6200	0.1300	11.5206		(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322		(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306		(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725		(30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.2139		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0500	1.0255
E3 Sill	11.8900	0.0500	0.5945
E4 Jamb	32.7900	0.0500	1.6395
E5 Ground floor (normal)	39.3500	0.1600	6.2960
E6 Intermediate floor within a dwelling	41.2600	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	15.8900	0.0600	0.9534
E12 Gable (insulation at ceiling level)	19.8400	0.0600	1.1904
E13 Gable (insulation at rafter level)	6.2000	0.0800	0.4960
E16 Corner (normal)	25.7100	0.0900	2.3139
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0900	-0.4626

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0466 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 104.2605 (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	87.3802	86.8442	86.3189	83.8513	83.3896	81.2404	81.2404	80.8424	82.0683	83.3896	84.3236	85.3000 (38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605 (39)
Average = Sum(39)m / 12 =												188.1096

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0744	1.0714	1.0684	1.0546	1.0520	1.0400	1.0400	1.0377	1.0446	1.0520	1.0573	1.0627 (40)
HLP (average)												1.0546
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												2.9737 (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												
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses												
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												70.6348 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547	(44)
Energy conte	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924 (45)
Energy content (annual)										Total =	Sum(45)m =	1173.0939
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:												
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	(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	(61)
Total heat required for water heating calculated for each month												
103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186	(62)
WWHRS	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	(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	(63c)
FGHRS	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	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186 (64)
12Total per year (kWh/year)												997.1298 (64)
Electric shower(s)	59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246 (64a)
												674.8135 (64a)
Heat gains from water heating, kWh/month	40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)												
54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011	54.3492	(72)
Total internal gains	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445	635.9273 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North				14.4500	10.6334		0.6300		0.7000		0.7700	46.9582 (74)
East				0.5000	19.6403		0.6300		0.7000		0.7700	3.0012 (76)
South				18.2000	46.7521		0.6300		0.7000		0.7700	260.0423 (78)
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948	1496.9547	1407.0775	1325.7666	1154.0758	985.2544	902.2425 (84)

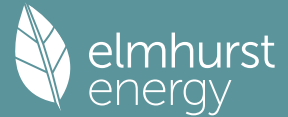
7. Mean internal temperature (heating season)

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	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062	50.6440
alpha	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937	4.3763
util living area	0.9962	0.9899	0.9771	0.9395	0.8537	0.6920	0.5279	0.5779	0.8033	0.9572	0.9915	0.9971 (86)
MIT	19.3330	19.5910	19.9230	20.3509	20.7027	20.9183	20.9806	20.9713	20.8348	20.3672	19.7727	19.2968 (87)
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359	20.0314 (88)
util rest of house	0.9952	0.9873	0.9709	0.9223	0.8117	0.6122	0.4219	0.4707	0.7363	0.9416	0.9888	0.9964 (89)
MIT 2	18.4935	18.7516	19.0814	19.5048	19.8281	20.0073	20.0438	20.0418	19.9476	19.5285	18.9423	18.4645 (90)
Living area fraction									fLA = Living area / (4) =			0.1259 (91)
MIT	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9931	0.9830	0.9638	0.9130	0.8066	0.6187	0.4348	0.4834	0.7373	0.9331	0.9850	0.9947 (94)
Useful gains	955.1524	1174.4412	1298.6550	1367.1440	1273.0918	963.9179	650.9079	680.2006	977.5128	1076.8644	970.4435	897.4369 (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)

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Heat loss rate W	2740.3067	2667.3032	2417.9584	2014.9352	1545.9004	1024.3351	660.7147	695.7691	1110.3987	1695.2574	2252.9929	2723.8548 (97)
Space heating kWh	1328.1548	1003.2033	832.7618	466.4097	202.9696	0.0000	0.0000	0.0000	0.0000	460.0843	923.4355	1358.8549 (98a)
Space heating requirement - total per year (kWh/year)												6575.8739
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	1328.1548	1003.2033	832.7618	466.4097	202.9696	0.0000	0.0000	0.0000	0.0000	460.0843	923.4355	1358.8549 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6575.8739
Space heating per m2												(98c) / (4) = 36.8665 (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	1743.7088	1372.7069	1406.7823	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8154	0.8869	0.8585	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1421.8749	1217.3980	1207.7434	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1739.0773	1671.0936	1569.6809	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	228.3857	337.5495	269.2815	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	57.0964	84.3874	67.3204	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												208.8042 (107)
Energy for space heating												36.8665 (99)
Energy for space cooling												1.1706 (108)
Total												38.0371 (109)
Fabric Energy Efficiency (TFEE)												38.0 (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)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (5)

2. Ventilation rate

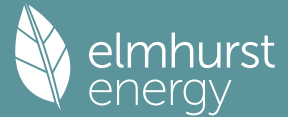
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (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	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												79.2000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3590	0.3540	0.3490	0.3240	0.3190	0.2940	0.2940	0.2890	0.3040	0.3190	0.3290	0.3390 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	20.5100	0.0230	0.4717	
E2 Other lintels (including other steel lintels)	11.8900	0.0200	0.2378	
E3 Sill	32.7900	0.0160	0.5246	
E4 Jamb	39.3500	0.0620	2.4397	
E5 Ground floor (normal)	41.2600	0.0010	0.0413	
E6 Intermediate floor within a dwelling	15.8900	0.0670	1.0646	
E10 Eaves (insulation at ceiling level)	19.8400	0.0550	1.0912	
E12 Gable (insulation at ceiling level)	6.2000	0.0400	0.2480	
E13 Gable (insulation at rafter level)	25.7100	0.0400	1.0284	
E16 Corner (normal)	5.1400	-0.0700	-0.3598	
E17 Corner (inverted - internal area greater than external area)			6.7876	(36)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			(36a) =	0.0000
Point Thermal bridges			(33) + (36) + (36a) =	86.9555 (37)
Total fabric heat loss				

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 52.8287 Feb 52.0930 Mar 51.3572 Apr 47.6783 May 46.9425 Jun 43.2636 Jul 43.2636 Aug 42.5279 Sep 44.7352 Oct 46.9425 Nov 48.4141 Dec 49.8856 (38)
Heat transfer coeff 139.7843 139.0485 138.3127 134.6338 133.8980 130.2192 130.2192 129.4834 131.6907 133.8980 135.3696 136.8412 (39)
Average = Sum(39)m / 12 = 134.4499

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7837	0.7796	0.7754	0.7548	0.7507	0.7301	0.7301	0.7259	0.7383	0.7507	0.7589	0.7672	(40)
HLP (average)												0.7538	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)	
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)	
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)	
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)	
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)	
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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)
0.0000	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)
Heat gains from water heating, kWh/month	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(65)

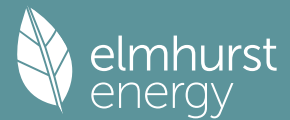
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
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				m2	Table 6a W/m2	Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W
North					14.4500	10.6334	0.6300	0.7000	0.7700			46.9582 (74)
East					0.5000	19.6403	0.6300	0.7000	0.7700			3.0012 (76)
South					18.2000	46.7521	0.6300	0.7000	0.7700			260.0423 (78)
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1112.9346	1321.9384	1478.4875	1597.1898	1660.9682	1615.7024	1550.9474	1466.6057	1394.0865	1251.3818	1102.3931	1045.9866 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770
util living area	0.9915	0.9779	0.9455	0.8602	0.7083	0.5108	0.3688	0.4050	0.6323	0.8940	0.9801	0.9937 (86)
MIT	20.2100	20.3797	20.5816	20.7928	20.9050	20.9426	20.9469	20.9468	20.9306	20.7816	20.4649	20.1908 (87)
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819 (88)
util rest of house	0.9896	0.9730	0.9339	0.8342	0.6651	0.4580	0.3116	0.3455	0.5754	0.8677	0.9748	0.9923 (89)
MIT 2	19.5373	19.7074	19.9060	20.1177	20.2148	20.2594	20.2617	20.2654	20.2450	20.1148	19.8083	19.5307 (90)
Living area fraction	fLA = Living area / (4) = 0.1259 (91)											
MIT	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9874	0.9692	0.9287	0.8305	0.6655	0.4604	0.3145	0.3484	0.5775	0.8636	0.9713	0.9905 (94)
Useful gains	1098.8759	1281.1590	1373.0995	1326.5437	1105.3187	743.9157	487.6985	510.9749	805.0736	1080.7466	1070.7107	1036.0587 (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	2141.7696	2070.7204	1865.9905	1521.7208	1151.7471	748.1652	488.0570	511.6129	820.6077	1285.2574	1731.5082	2109.2410 (97)
Space heating kWh	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476 (98a)
Space heating requirement - total per year (kWh/year)	3274.6572											
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	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3274.6572											
Space heating per m2	(98c) / (4) = 18.3588 (99)											
9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)	0.0000 (201)											
Efficiency of main space heating system 1 (in %)	1.0000 (202)											
Efficiency of main space heating system 2 (in %)	84.0000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (207)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	923.7058	631.6491	436.5606	167.2947	41.1223	0.0000	0.0000	0.0000	0.0000	181.1381	566.3979	950.5329 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
Efficiency of water heater (217)m	88.3577	88.2306	87.9933	87.5092	86.9236	86.6000	86.6000	86.6000	86.6000	87.5507	88.1747	86.6000 (216)
Fuel for water heating, kWh/month	312.2675	276.1219	292.9895	256.2280	248.1507	222.3592	217.9136	227.7111	231.4819	257.7906	275.1843	308.4224 (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	56.4664	51.0019	56.4664	54.6449	56.4664	54.6449	56.4664	56.4664	54.6449	56.4664	54.6449	56.4664 (231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-98.8185	-129.0481	-172.2243	-181.5623	-188.1262	-173.6718	-172.2287	-166.6388	-156.0410	-142.0084	-105.4596	-86.9854 (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	3898.4015 (211)											
Space heating fuel - main system 2	0.0000 (213)											

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	86.6000
Water heating fuel used	3126.6209 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)	
mechanical ventilation fans (SFP = 1.0640)	578.8463 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	664.8463 (231)
Electricity for lighting (calculated in Appendix L)	325.0287 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1772.8130 (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	6242.0844 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3898.4015	3.6400	141.9018 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3126.6209	3.6400	113.8090 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	664.8463	16.4900	109.6332 (249)
Energy for lighting	325.0287	16.4900	53.5972 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1772.8130	16.4900	-292.3369
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-292.3369 (252)
Total energy cost			218.6043 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3523 (257)
SAP value		94.2889
SAP rating (Section 12)		94 (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	3898.4015	0.2100	818.6643 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3126.6209	0.2100	656.5904 (264)
Space and water heating			1475.2547 (265)
Pumps, fans and electric keep-hot	664.8463	0.1387	92.2224 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1772.8130	0.1359	-240.9762
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-240.9762 (269)
Total CO2, kg/year			1373.4126 (272)
CO2 emissions per m2			7.7000 (273)
EI value			91.7609
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

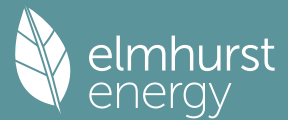
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n) =	445.9250 (5)

2. Ventilation rate

m3 per hour

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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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000	Air changes per hour	0.0000 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50				4.0000 (17)
Infiltration rate				0.2000 (18)
Number of sides sheltered				0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)		
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)		

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Adj infilt rate	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Balanced mechanical ventilation with heat recovery	0.2550	0.2350	0.2300	0.2150	0.2150	0.2000	0.2000	0.1950	0.2000	0.2250	0.2200	0.2350	(22b)
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													79.2000 (23c)
Effective ac	0.3590	0.3390	0.3340	0.3190	0.3190	0.3040	0.3040	0.2990	0.3040	0.3290	0.3240	0.3390	(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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...	(30) + (32) =	80.1680			(33)

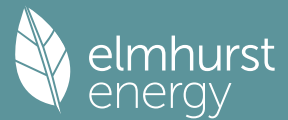
Heat capacity Cm = Sum(A x k)	(28)...	(30) + (32) + (32a)...	(32e) =	34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				193.7565 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717	
E3 Sill	11.8900	0.0200	0.2378	
E4 Jamb	32.7900	0.0160	0.5246	
E5 Ground floor (normal)	39.3500	0.0620	2.4397	
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413	
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646	
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912	
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480	
E16 Corner (normal)	25.7100	0.0400	1.0284	
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)	
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =			86.9555 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	52.8287	49.8856	49.1499	46.9425	46.9425	44.7352	44.7352	43.9994	44.7352	48.4141	47.6783	49.8856	(38)
Average = Sum(39)m / 12 =	139.7843	136.8412	136.1054	133.8980	133.8980	131.6907	131.6907	130.9549	131.6907	135.3696	134.6338	136.8412	(39)
													134.4499
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.7837	0.7672	0.7631	0.7507	0.7507	0.7383	0.7383	0.7342	0.7383	0.7589	0.7548	0.7672	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)													138.9328 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy content (annual)	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Distribution loss (46)m = 0.15 x (45)m													2307.6445
	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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)

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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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(64)
Total per year (kWh/year) = Sum(64)m =													2737.1231 (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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(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					14.4500	13.8645		0.6300	0.7000	0.7700		61.2273 (74)	
East					0.5000	25.9136		0.6300	0.7000	0.7700		3.9598 (76)	
South					18.2000	58.2505		0.6300	0.7000	0.7700		323.9985 (78)	
Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426	(83)
Total gains	1192.1185	1359.9608	1528.4733	1684.7122	1720.4991	1765.5442	1667.0751	1585.4210	1499.8927	1329.0833	1192.5580	1099.0141	(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	68.6780	70.1550	70.5343	71.6971	71.6971	72.8988	72.8988	73.3084	72.8988	70.9177	71.3052	70.1550
alpha	5.5785	5.6770	5.7023	5.7798	5.7798	5.8599	5.8599	5.8872	5.8599	5.7278	5.7537	5.6770
util living area	0.9841	0.9679	0.9212	0.8074	0.6332	0.4162	0.2921	0.3054	0.5209	0.8223	0.9569	0.9883 (86)
MIT	20.3433	20.4797	20.6718	20.8463	20.9250	20.9455	20.9469	20.9471	20.9417	20.8543	20.6125	20.3254 (87)
Th 2	20.2675	20.2819	20.2855	20.2963	20.2963	20.3071	20.3071	20.3107	20.3071	20.2891	20.2927	20.2819 (88)
util rest of house	0.9803	0.9608	0.9051	0.7754	0.5862	0.3654	0.2375	0.2486	0.4631	0.7831	0.9457	0.9854 (89)
MIT 2	19.6692	19.8147	20.0008	20.1669	20.2293	20.2535	20.2541	20.2580	20.2516	20.1699	19.9544	19.6643 (90)
Living area fraction	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (91)
MIT	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9564	0.9000	0.7733	0.5876	0.3678	0.2402	0.2514	0.4658	0.7811	0.9410	0.9828	(94)
Useful gains	1164.7224	1300.6319	1375.6636	1302.8205	1010.9101	649.4479	400.4463	398.6362	698.5995	1038.1967	1122.1718	1080.0889	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	2006.4697	1942.9265	1740.1467	1426.3446	1033.2829	650.6326	400.5178	398.7244	703.0282	1144.6929	1566.7645	1949.6469	(97)
Space heating kWh	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511	(98a)
Space heating requirement - total per year (kWh/year)												2480.9311	
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	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2480.9311	
Space heating per m2										(98c) / (4) =		13.9089	(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 %)													84.0000 (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	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511	(98)

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Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	745.5476	513.8357	322.8279	105.8779	19.8159	0.0000	0.0000	0.0000	0.0000	94.3252	381.0794	770.1799	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(64)
Efficiency of water heater	88.2520	88.1189	87.8139	87.2683	86.7676	86.6000	86.6000	86.6000	86.6000	87.2111	87.9491	86.6000	(216)
Fuel for water heating, kWh/month	312.6413	276.4718	293.5881	256.9351	248.5966	222.3592	217.9136	227.7111	231.4819	258.7946	275.8902	308.7783	(217)
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	56.4664	51.0019	56.4664	54.6449	56.4664	54.6449	56.4664	56.4664	54.6449	56.4664	54.6449	56.4664	(231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-116.5157	-135.8433	-179.2626	-188.7084	-191.6293	-180.1532	-177.6111	-173.5887	-164.6146	-152.6578	-122.0953	-99.9658	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												2953.4894	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												86.6000	
Water heating fuel used												3131.1619	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)													
mechanical ventilation fans (SFP = 1.0640)												578.8463	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												664.8463	(231)
Electricity for lighting (calculated in Appendix L)												325.0287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1882.6458	(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												5191.8806	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2953.4894	5.6000	165.3954	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3131.1619	5.6000	175.3451	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	664.8463	26.0600	173.2590	(249)
Energy for lighting	325.0287	26.0600	84.7025	(250)
Additional standing charges			99.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1882.6458	26.0600	-490.6175	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-490.6175	(252)
Total energy cost			207.0844	(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	2953.4894	0.2100	620.2328	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3131.1619	0.2100	657.5440	(264)
Space and water heating			1277.7768	(265)
Pumps, fans and electric keep-hot	664.8463	0.1387	92.2224	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1882.6458	0.1364	-256.7849	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-256.7849	(269)
Total CO2, kg/year			1160.1259	(272)

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

Energy Primary energy factor Primary energy

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Space heating - main system 1	kWh/year	kg CO2/kWh	kWh/year
Total CO2 associated with community systems	2953.4894	1.1300	3337.4431 (275)
Water heating (other fuel)			0.0000 (473)
Space and water heating	3131.1619	1.1300	3538.2129 (278)
Pumps, fans and electric keep-hot	664.8463	1.5128	6875.6560 (279)
Energy for lighting	325.0287	1.5338	1005.7795 (281)
			498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1882.6458	1.5042	-2831.8236
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2831.8236 (283)
Total Primary energy kWh/year			5548.1517 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 94
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 -£ 33 -177 kg (15.2%)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 547 TEST (31 May 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£258	£258	£0
Mains gas	£440	£440	£0
Space heating	£438	£438	£0
Water heating	£175	£175	£0
Lighting	£85	£85	£0
Generated (PV)	-£491	-£491	£0
Total cost of fuels	£207	£207	£0
Total cost of uses	£207	£207	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	7 kg/m²	7 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

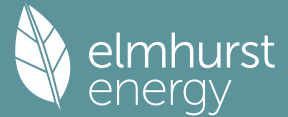
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	

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Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													4.0000 (17)
Infiltration rate													0.2000 (18)
Number of sides sheltered													0 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.2000 (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	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													79.2000 (23c)
Effective ac	0.3590	0.3540	0.3490	0.3240	0.3190	0.2940	0.2940	0.2890	0.3040	0.3190	0.3290	0.3390	(25)

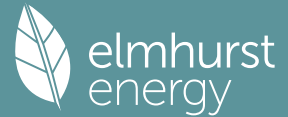
3. Heat losses and heat loss parameter

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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.1680			(33)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34560.3500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.7565	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				20.5100	0.0230	0.4717		
E3 Sill				11.8900	0.0200	0.2378		
E4 Jamb				32.7900	0.0160	0.5246		
E5 Ground floor (normal)				39.3500	0.0620	2.4397		
E6 Intermediate floor within a dwelling				41.2600	0.0010	0.0413		
E10 Eaves (insulation at ceiling level)				15.8900	0.0670	1.0646		
E12 Gable (insulation at ceiling level)				19.8400	0.0550	1.0912		
E13 Gable (insulation at rafter level)				6.2000	0.0400	0.2480		
E16 Corner (normal)				25.7100	0.0400	1.0284		
E17 Corner (inverted - internal area greater than external area)				5.1400	-0.0700	-0.3598		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7876	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	86.9555	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9737	(42)
Hot water usage for mixer showers													
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)	
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)	
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)	
Average daily hot water use (litres/day)												138.9328	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)												Total = Sum(45)m =	2307.6445
Distribution loss (46)m = 0.15 x (45)m													
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)	
Water storage 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	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	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363	(61)
Total heat required for water heating calculated for each month													
275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(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	88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715	(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					14.4500	10.6334	0.6300	0.7000			0.7700	46.9582 (74)	
East					0.5000	19.6403	0.6300	0.7000			0.7700	3.0012 (76)	
South					18.2000	46.7521	0.6300	0.7000			0.7700	260.0423 (78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152	(83)
Total gains	1112.9346	1321.9384	1478.4875	1597.1898	1660.9682	1615.7024	1550.9474	1466.6057	1394.0865	1251.3818	1102.3931	1045.9866	(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	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550	
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770	
util living area	0.9915	0.9779	0.9455	0.8602	0.7083	0.5108	0.3688	0.4050	0.6323	0.8940	0.9801	0.9937	(86)
MIT	20.2100	20.3797	20.5816	20.7928	20.9050	20.9426	20.9469	20.9468	20.9306	20.7816	20.4649	20.1908	(87)
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819	(88)
util rest of house	0.9896	0.9730	0.9339	0.8342	0.6651	0.4580	0.3116	0.3455	0.5754	0.8677	0.9748	0.9923	(89)
MIT 2	19.5373	19.7074	19.9060	20.1177	20.2148	20.2594	20.2617	20.2654	20.2450	20.1148	19.8083	19.5307	(90)
Living area fraction	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138	(91)
MIT	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138	(92)
Temperature adjustment	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138	(93)
adjusted MIT	19.6220	19.7921	19.9911	20.2027	20.3017	20.3454	20.3480	20.3512	20.3313	20.1988	19.8910	19.6138	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9874	0.9692	0.9287	0.8305	0.6655	0.4604	0.3145	0.3484	0.5775	0.8636	0.9713	0.9905	(94)
Useful gains	1098.8759	1281.1590	1373.0995	1326.5437	1105.3187	743.9157	487.6985	510.9749	805.0736	1080.7466	1070.7107	1036.0587	(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	2141.7696	2070.7204	1865.9905	1521.7208	1151.7471	748.1652	488.0570	511.6129	820.6077	1285.2574	1731.5082	2109.2410	(97)
Space heating kWh	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476	(98a)
Space heating requirement - total per year (kWh/year)												3274.6572	
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	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3274.6572	
Space heating per m2										(98c) / (4) =		18.3588	(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 %)

84.0000 (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	775.9129	530.5853	366.7109	140.5276	34.5427	0.0000	0.0000	0.0000	0.0000	152.1560	475.7742	798.4476	(98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000	(210)
Space heating fuel (main heating system)	923.7058	631.6491	436.5606	167.2947	41.1223	0.0000	0.0000	0.0000	0.0000	181.1381	566.3979	950.5329	(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)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3898.4015	0.2100	818.6643 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	3126.6209	0.2100	656.5904 (264)
Space and water heating			1475.2547 (265)
Pumps, fans and electric keep-hot	664.8463	0.1387	92.2224 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1772.8130	0.1359	-240.9762
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-240.9762 (269)
Total CO ₂ , kg/year			1373.4126 (272)
CO ₂ emissions per m ²			7.7000 (273)
EI value			91.7609
EI rating			92 (274)
EI band			A

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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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (5)

2. Ventilation rate

	m ³ 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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.2550	0.2350	0.2300	0.2150	0.2150	0.2000	0.2000	0.1950	0.2000	0.2250	0.2200	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												79.2000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3590	0.3390	0.3340	0.3190	0.3190	0.3040	0.3040	0.2990	0.3040	0.3290	0.3240	0.3390 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983		(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000 (28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000 (29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000 (29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500 (30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680		(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.7565 (35)

List of Thermal Bridges

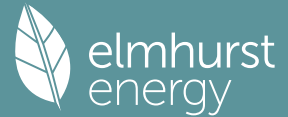
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 86.9555 (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	52.8287	49.8856	49.1499	46.9425	46.9425	44.7352	44.7352	43.9994	44.7352	48.4141	47.6783	49.8856 (38)
Heat transfer coeff	139.7843	136.8412	136.1054	133.8980	133.8980	131.6907	131.6907	130.9549	131.6907	135.3696	134.6338	136.8412 (39)
Average = Sum(39)m / 12 =												134.4499

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7837	0.7672	0.7631	0.7507	0.7507	0.7383	0.7383	0.7342	0.7383	0.7589	0.7548	0.7672 (40)
HLP (average)												0.7538
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												2.9737 (42)
Hot water usage for mixer showers												
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths												
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses												
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												138.9328 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494 (44)
Energy content	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371 (45)
Energy content (annual)												Total = Sum(45)m = 2307.6445
Distribution loss (46)m = 0.15 x (45)m												
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage 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	(59)
Combi loss	36.5413	32.9967	36.5142	35.2985	36.4511	35.2511	36.4107	36.4234	35.2629	36.4661	35.3261	36.5363 (61)
Total heat required for water heating calculated for each month												
275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734	(62)
WWHRS	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	(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	(63c)
FGHRS	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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
Total per year (kWh/year) = Sum(64)m =												2737.1231 (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												
88.7262	78.2827	82.7098	71.6420	68.7135	61.1190	59.7432	62.5634	63.7449	72.0360	77.7644	87.6164	(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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)												
119.2556	116.4921	111.1691	99.5028	92.3568	84.8875	80.3001	84.0905	88.5346	96.8225	108.0060	117.7640	(72)
Total internal gains	802.9329	800.4456	773.8311	725.0107	674.8033	629.9037	603.5463	607.0606	632.7962	678.2383	732.4832	779.6715 (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					14.4500	13.8645		0.6300	0.7000	0.7700		61.2273 (74)
East					0.5000	25.9136		0.6300	0.7000	0.7700		3.9598 (76)
South					18.2000	58.2505		0.6300	0.7000	0.7700		323.9985 (78)
Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426 (83)
Total gains	1192.1185	1359.9608	1528.4733	1684.7122	1720.4991	1765.5442	1667.0751	1585.4210	1499.8927	1329.0833	1192.5580	1099.0141 (84)

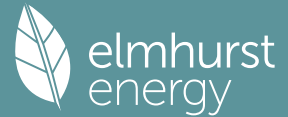
7. Mean internal temperature (heating season)

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	68.6780	70.1550	70.5343	71.6971	71.6971	72.8988	72.8988	73.3084	72.8988	70.9177	71.3052	70.1550
alpha	5.5785	5.6770	5.7023	5.7798	5.7798	5.8599	5.8599	5.8872	5.8599	5.7278	5.7537	5.6770
util living area	0.9841	0.9679	0.9212	0.8074	0.6332	0.4162	0.2921	0.3054	0.5209	0.8223	0.9569	0.9883 (86)
MIT	20.3433	20.4797	20.6718	20.8463	20.9250	20.9455	20.9469	20.9471	20.9417	20.8543	20.6125	20.3254 (87)
Th 2	20.2675	20.2819	20.2855	20.2963	20.2963	20.3071	20.3071	20.3107	20.3071	20.2891	20.2927	20.2819 (88)
util rest of house	0.9803	0.9608	0.9051	0.7754	0.5862	0.3654	0.2375	0.2486	0.4631	0.7831	0.9457	0.9854 (89)
MIT 2	19.6692	19.8147	20.0008	20.1669	20.2293	20.2535	20.2541	20.2580	20.2516	20.1699	19.9544	19.6643 (90)
Living area fraction	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (92)
MIT	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (93)
Temperature adjustment												0.0000
adjusted MIT	19.7540	19.8984	20.0853	20.2525	20.3169	20.3406	20.3414	20.3447	20.3385	20.2561	20.0372	19.7475 (93)

8. Space heating requirement

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

Full SAP Calculation Printout



Utilisation	0.9770	0.9564	0.9000	0.7733	0.5876	0.3678	0.2402	0.2514	0.4658	0.7811	0.9410	0.9828 (94)
Useful gains	1164.7224	1300.6319	1375.6636	1302.8205	1010.9101	649.4479	400.4463	398.6362	698.5995	1038.1967	1122.1718	1080.0889 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	2006.4697	1942.9265	1740.1467	1426.3446	1033.2829	650.6326	400.5178	398.7244	703.0282	1144.6929	1566.7645	1949.6469 (97)
Space heating kWh	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511 (98a)
Space heating requirement - total per year (kWh/year)												2480.9311
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	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2480.9311
Space heating per m2										(98c) / (4) =		13.9089 (99)

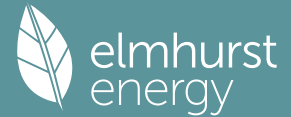
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												84.0000 (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	626.2600	431.6220	271.1754	88.9374	16.6453	0.0000	0.0000	0.0000	0.0000	79.2332	320.1067	646.9511 (98)
Space heating efficiency (main heating system 1)	84.0000	84.0000	84.0000	84.0000	84.0000	0.0000	0.0000	0.0000	0.0000	84.0000	84.0000	84.0000 (210)
Space heating fuel (main heating system)	745.5476	513.8357	322.8279	105.8779	19.8159	0.0000	0.0000	0.0000	0.0000	94.3252	381.0794	770.1799 (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	275.9122	243.6239	257.8112	224.2230	215.7014	192.5631	188.7132	197.1978	200.4634	225.6975	242.6429	272.5734 (64)
Efficiency of water heater (217)m	88.2520	88.1189	87.8139	87.2683	86.7676	86.6000	86.6000	86.6000	86.6000	87.2111	87.9491	86.6000 (216)
Fuel for water heating, kWh/month	312.6413	276.4718	293.5881	256.9351	248.5966	222.3592	217.9136	227.7111	231.4819	258.7946	275.8902	88.2748 (217)
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	56.4664	51.0019	56.4664	54.6449	56.4664	54.6449	56.4664	56.4664	54.6449	56.4664	54.6449	56.4664 (231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-116.5157	-135.8433	-179.2626	-188.7084	-191.6293	-180.1532	-177.6111	-173.5887	-164.6146	-152.6578	-122.0953	-99.9658 (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												2953.4894 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												86.6000
Water heating fuel used												3131.1619 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)												
mechanical ventilation fans (SFP = 1.0640)												578.8463 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												664.8463 (231)
Electricity for lighting (calculated in Appendix L)												325.0287 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1882.6458 (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												5191.8806 (238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2953.4894	5.6000	165.3954 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3131.1619	5.6000	175.3451 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	664.8463	26.0600	173.2590 (249)
Energy for lighting	325.0287	26.0600	84.7025 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1882.6458	26.0600	-490.6175
PV Unit electricity exported	0.0000	5.8100	0.0000

Full SAP Calculation Printout



Total	-490.6175 (252)
Total energy cost	207.0844 (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	2953.4894	0.2100	620.2328 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3131.1619	0.2100	657.5440 (264)
Space and water heating			1277.7768 (265)
Pumps, fans and electric keep-hot	664.8463	0.1387	92.2224 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1882.6458	0.1364	-256.7849
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-256.7849 (269)
Total CO2, kg/year			1160.1259 (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	2953.4894	1.1300	3337.4431 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3131.1619	1.1300	3538.2129 (278)
Space and water heating			6875.6560 (279)
Pumps, fans and electric keep-hot	664.8463	1.5128	1005.7795 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1882.6458	1.5042	-2831.8236
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2831.8236 (283)
Total Primary energy kWh/year			5548.1517 (286)

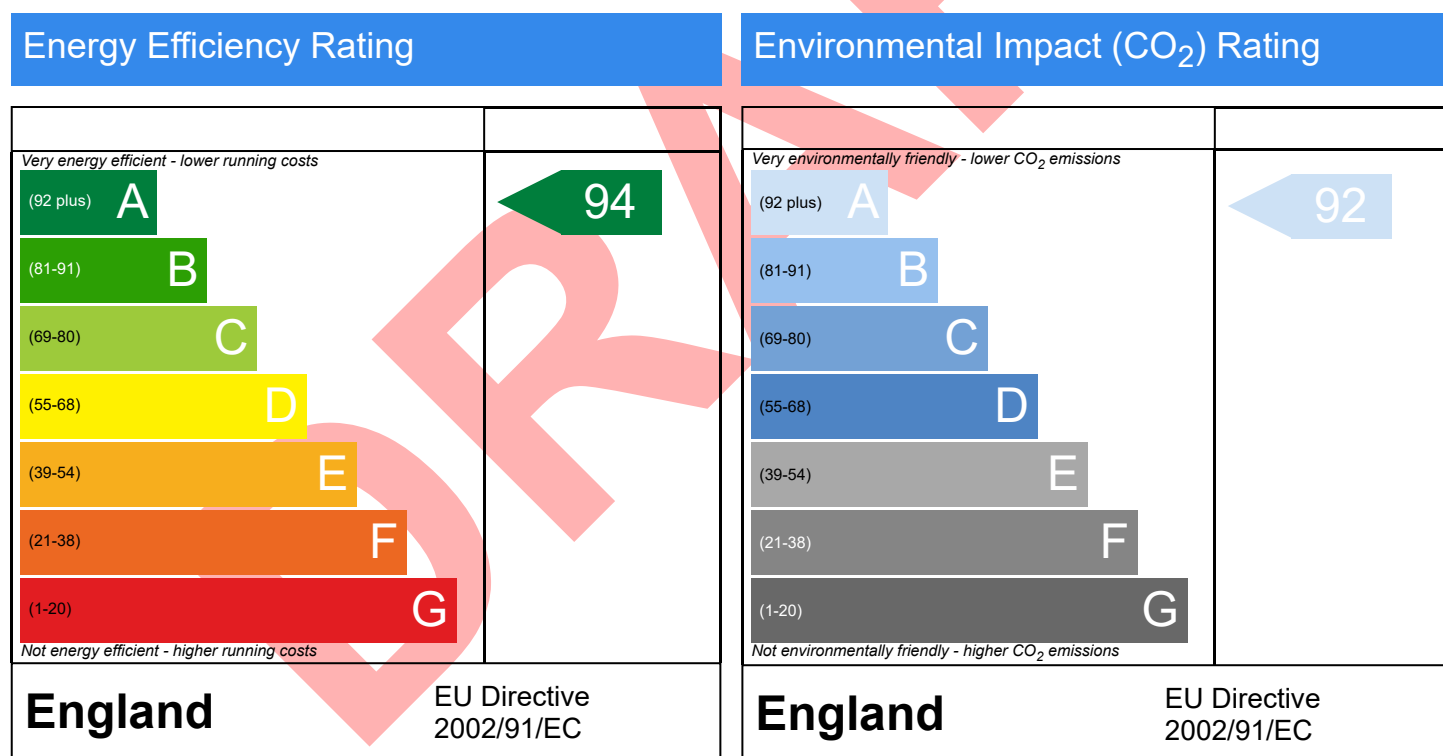
Predicted Energy Assessment



Dwelling type: House, Detached
Date of assessment: 25/06/2024
Produced by: James Gradwell
Total floor area: 178.37 m²
DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data

Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Paul Giesberg	
Property				

SAP Rating	94 A	DER	8.04	TER	8.49
Environmental	92 A	% DER < TER			5.30
CO ₂ Emissions (t/year)	1.16	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	10.50	DPER	39.83	TPER	44.50

Assessor Details	Mr. James Gradwell	Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenture	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground floor:	39.35 m	88.62 m ²	2.50 m
	1st Storey:	41.26 m	89.75 m ²	2.50 m

8.0 Living Area	22.46	m ²
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Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
Brickwork	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	106.24	86.29	0.00	None	19.95	Enter Gross Area
Render	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	98.37	85.17	0.00	None	13.20	Enter Gross Area

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	89.75	89.75	None	0.00	Enter Gross Area	0.00

Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	110.00	88.62

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.90

Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
NORTH	Glazing	Brickwork	North	6.55	
NORTH RENDER	Glazing	Render	North	7.90	
SOUTH	Glazing	Brickwork	South	13.40	
SOUTH RENDER	Glazing	Render	South	4.80	
EAST	Glazing	Render	East	0.50	

Summary for Input Data

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges
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17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	20.51	0.02	0.02 RCD	No
E3 Sill	Non Gov Approved Schemes	11.89	0.02	0.02 RCD	No
E4 Jamb	Non Gov Approved Schemes	32.79	0.02	0.02 RCD	No
E5 Ground floor (normal)	Non Gov Approved Schemes	39.35	0.06	0.06 RCD	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	41.26	0.00	0.00 RCD	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	15.89	0.07	0.07 RCD	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	19.84	0.06	0.06 RCD	No
E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	6.20	0.04	0.04 RCD	No
E16 Corner (normal)	Non Gov Approved Schemes	25.71	0.04	0.04 RCD	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	5.14	-0.07	-0.07 RCD	No

Y-value	0.02	W/m²K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	4.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation	
Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500794
Configuration	4
Manufacturer SFP	0.76
Duct Type	Rigid
MVHR Efficiency	88.00
Wet Rooms	4
SFP from Installer Commissioning Certificate	No
MVHR System Location	Inside heated envelope (installed exclusively)
Duct Installation Specification	Level 1

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No
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22.0 Lighting

No Fixed Lighting	No				
	Name	Efficacy	Power	Capacity	Count
	Lighting	80.00	5	400	40

24.0 Main Heating 1

	Database	
Percentage of Heat	100.00	%
Database Ref. No.	17507	
Fuel Type	Mains gas	
In Winter	84.00	
In Summer	86.60	
Model Name	Greenstar	
Manufacturer	Bosch Thermotechnology	
System Type	Combi boiler	
Controls SAP Code	2106	
Delayed Start Stat	No	

Summary for Input Data

Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in unheated space
Heating Pump Age	2013 or later
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value
Flow Temperature Value	35.00
Boiler Interlock	No
Combi boiler type	Standard Combi
Combi keep hot type	Gas/Oil, time clock

25.0 Main Heating 2	None
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26.0 Heat Networks	None
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28.0 Water Heating	
Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	Yes
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers						
Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To	

28.3 Waste Water Heat Recovery System Instantaneous System 1	
Database ID	80188
Brand Model	Showersave, Showersave QB1-21 Cyclone
Details	Year: 2021 + current Efficiency: 0 Utilisation factor: 0.973

29.0 Hot Water Cylinder	None
In Airing Cupboard	No

32.0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
6.50	South	45°	None Or Little		No	1.00		

34.0 Small-scale Hydro				None							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations
Lower cost measures
 None
Further measures to achieve even higher standards

Summary for Input Data



Typical Cost

Typical savings per year

Ratings after improvement
SAP rating Environmental Impact
A 95 A 93
0 0
0 0

Thermal Bridging

Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Detached House	
Property				

SAP Rating	94 A	DER	8.04	TER	8.49
Environmental	92 A	% DER < TER			5.30
CO ₂ Emissions (t/year)	1.16	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	10.50	DPER	39.83	TPER	44.50

Assessor Details	Mr. James Gradwell	Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	0.023	20.51	0.47	RCD
External wall	E3 Sill	Non Gov Approved Schemes	0.020	11.89	0.24	RCD
External wall	E4 Jamb	Non Gov Approved Schemes	0.016	32.79	0.52	RCD
External wall	E5 Ground floor (normal)	Non Gov Approved Schemes	0.062	39.35	2.44	RCD
External wall	E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	0.001	41.26	0.04	RCD
External wall	E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	0.067	15.89	1.06	RCD
External wall	E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	0.055	19.84	1.09	RCD
External wall	E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	0.040	6.20	0.25	RCD
External wall	E16 Corner (normal)	Non Gov Approved Schemes	0.040	25.71	1.03	RCD
External wall	E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	-0.070	5.14	-0.36	RCD

Total: 218.58 W/mK:
Y-Value: 0.02 W/m²K:

Overview Report

Dwelling Address	
Report Date	25/06/2024
Property Type	House, Detached
Floor Area [m ²]	178

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL

(92 plus)

A

94

94

(81-91)

B

(69-80)

C

(55-68)

D

(39-54)

E

(21-38)

F

(1-20)

G

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good
-----------	------	---------	------	-----------

Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.12 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Boiler with radiators and underfloor heating, mains gas	Good
Main heating controls	Programmer, room thermostat and TRVs	Good
Secondary heating	None	
Hot water	From main system, waste water heat recovery	Very Good
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 4.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 31 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **1.2** per year

Overview Report

With the recommended measures the potential CO emissions could be: **0.0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating		 1	£33	 A 95
Photovoltaic		 -95	£240	 G 0

Estimated energy use and potential savings

Estimated energy cost for
this property over a year

£207

Over a year you could
save

£0

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details

Assessor name	Mr. James Gradwell
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	25/06/2024
Date of certificate	25/06/2024
Type of assessment	SAP, new dwelling

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 25 Jun 2024 21:48:53

Project Information			
Assessed By	James Gradwell	Building Type	House, Detached
OCDEA Registration	EES/028346	Assessment Date	2024-06-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	178 m ²
Site Reference	Paul Giesberg	Plot Reference	00001
Address			

Client Details	
Name	Paul Giesberg
Company	Planning for sustainability
Address	164 Harefield Road , Uxbridge , UB8 1PP

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	8.33 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	1.19 kgCO ₂ /m ²		OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	43.66 kWh _{PE} /m ²		
Dwelling primary energy	11.85 kWh _{PE} /m ²		OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	38.0 kWh/m ²		
Dwelling fabric energy efficiency	31.9 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	N/A	N/A	N/A
Curtain walls	1.6	N/A	N/A	N/A
Floors	0.18	0.12	Heatloss Floor 1 (0.12)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	0.9	NORTH (0.9)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	86.29	0.18	
Exposed wall: Walls (2)	85.17	0.18	
Ground floor: Heatloss Floor 1, Heatloss Floor 1	88.62	0.12	
Exposed roof: Roof (1)	89.75	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
NORTH, Glazing	6.55	North	0.7	0.9 (!)
NORTH RENDER , Glazing	7.9	North	0.7	0.9 (!)
SOUTH , Glazing	13.4	South	0.7	0.9 (!)
SOUTH RENDER , Glazing	4.8	South	0.7	0.9 (!)
EAST, Glazing	0.5	East	0.7	0.9 (!)

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.023 (!)	RCD

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.02 (!)	RCD
External wall	E4: Jamb	Not government-approved scheme	0.016 (!)	RCD
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.062	RCD
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0.001 (!)	RCD
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.067	RCD
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.055	RCD
External wall	E13: Gable (insulation at rafter level)	Not government-approved scheme	0.04	RCD
External wall	E16: Corner (normal)	Not government-approved scheme	0.04	RCD
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.07	RCD

3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m ³ /hm ²	
Dwelling air permeability at 50Pa	4 m ³ /hm ² , Design value	OK
Air permeability test certificate reference		

4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	391.5%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Mitsubishi Electric Europe B.V.
Model	Ecodan 11.2 kW
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water

Cylinder/store - type: Cylinder

Capacity	200 litres
Declared heat loss	2.5 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

6 Controls

Main heating 1 - type: Programmer, room thermostat and TRVs

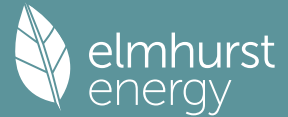
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.76 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	88%	OK
Manufacturer/Model	MRXBOXAB-ECO3, MRXBOXAB-ECO3C	
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	7 kWp	
Orientation	South	
Pitch	45°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Full SAP Calculation Printout



Property Reference	Paul Giesberg				Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref		Paul Giesberg		
Property						
SAP Rating	95 A	DER	1.19	TER	8.33	
Environmental	99 A	% DER < TER				85.71
CO ₂ Emissions (t/year)	0.15	DFEE	31.94	TFEE	38.04	
Compliance Check	See BREL	% DFEE < TFEE				16.03
% DPER < TPER	72.86	DPER	11.85	TPER	43.66	
Assessor Details	Mr. James Gradwell				Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg					

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

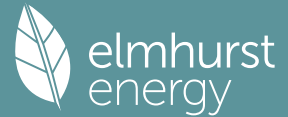
2. Ventilation rate

	m ³ 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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 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	0.2550 0.2500 0.2450 0.2200 0.2150 0.1900 0.1900 0.1850 0.2000 0.2150 0.2250 0.2350 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)
Effective ac	0.3590 0.3540 0.3490 0.3240 0.3190 0.2940 0.2940 0.2890 0.3040 0.3190 0.3290 0.3390 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983		(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000 (28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000 (29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000 (29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500 (30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680		(33)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.7565 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				20.5100	0.0230	0.4717	
E3 Sill				11.8900	0.0200	0.2378	

Full SAP Calculation Printout



E4 Jamb													32.7900	0.0160	0.5246	
E5 Ground floor (normal)													39.3500	0.0620	2.4397	
E6 Intermediate floor within a dwelling													41.2600	0.0010	0.0413	
E10 Eaves (insulation at ceiling level)													15.8900	0.0670	1.0646	
E12 Gable (insulation at ceiling level)													19.8400	0.0550	1.0912	
E13 Gable (insulation at rafter level)													6.2000	0.0400	0.2480	
E16 Corner (normal)													25.7100	0.0400	1.0284	
E17 Corner (inverted - internal area greater than external area)													5.1400	-0.0700	-0.3598	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)																6.7876 (36)
Point Thermal bridges																0.0000
Total fabric heat loss															(33) + (36) + (36a) =	86.9555 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)																
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Heat transfer coeff	52.8287	52.0930	51.3572	47.6783	46.9425	43.2636	43.2636	42.5279	44.7352	46.9425	48.4141	49.8856	(38)			
Average = Sum(39)m / 12 =	139.7843	139.0485	138.3127	134.6338	133.8980	130.2192	130.2192	129.4834	131.6907	133.8980	135.3696	136.8412	(39)			
													134.4499			
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
HLP (average)	0.7837	0.7796	0.7754	0.7548	0.7507	0.7301	0.7301	0.7259	0.7383	0.7507	0.7589	0.7672	(40)			
Days in month	31	28	31	30	31	30	31	31	30	31	30	31				

4. Water heating energy requirements (kWh/year)																

Assumed occupancy																2.9737 (42)
Hot water usage for mixer showers																
	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)			
Hot water usage for baths																
	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)			
Hot water usage for other uses																
	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)			
Average daily hot water use (litres/day)													138.9328	(43)		
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Energy conte	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)			
Energy content (annual)	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)			
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m =	2307.6445		
	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)			
Water storage loss:																
Store volume													200.0000	(47)		
a) If manufacturer declared loss factor is known (kWh/day):													2.5000	(48)		
Temperature factor from Table 2b													0.5400	(49)		
Enter (49) or (54) in (55)													1.3500	(55)		
Total storage loss																
	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(56)			
If cylinder contains dedicated solar storage																
	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(57)			
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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																
	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(64)			
												3074.2905	(64)			
12Total per year (kWh/year)												3074	(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)			
												0.0000	(64a)			
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =																
Heat gains from water heating, kWh/month																
	131.6808	117.0825	125.6712	113.2270	111.6906	102.7159	102.7305	105.5474	105.3388	115.0094	119.3424	130.5723	(65)			

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

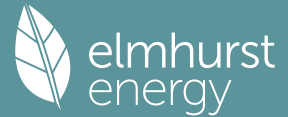
Metabolic gains (Table 5), Watts																
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)			
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231	(67)			
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500	(68)			
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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)			
Water heating gains (Table 5)	176.9903	174.2299	168.9129	157.2597	150.1218	142.6609	138.0786	141.8648	146.3038	154.5825	165.7534	175.5004	(72)			
Total internal gains	774.0110	794.1064	760.4133	735.2573	697.5439	672.9482	646.9425	647.0969	666.6688	688.4504	730.1968	757.0785	(73)			

6. Solar gains																

[Jan]																
			Area		Solar flux		g		FF		Access		Gains			
			m2		Table 6a		W/m2		Specific data		factor		W			
					or Table 6b				or Table 6c		Table 6d					
North			14.4500		10.6334		0.6300		0.7000		0.7700		46.9582	(74)		
East			0.5000		19.6403		0.6300		0.7000		0.7700		3.0012	(76)		
South			18.2000		46.7521		0.6300		0.7000		0.7700		260.0423	(78)		

Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152	(83)			
Total gains	1084.0127	1315.5991	1465.0698	1607.4364	1683.7088	1658.7469	1594.3436	1506.6420	1427.9591	1261.5939	1100.1067	1023.3937	(84)			

Full SAP Calculation Printout



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	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770
util living area	0.9925	0.9784	0.9474	0.8576	0.7009	0.4981	0.3588	0.3944	0.6192	0.8911	0.9803	0.9944 (86)
Living	20.1935	20.3763	20.5757	20.7955	20.9071	20.9432	20.9470	20.9469	20.9323	20.7849	20.4637	20.1778
Non living	19.5210	19.7042	19.9005	20.1200	20.2163	20.2597	20.2617	20.2654	20.2460	20.1177	19.8071	19.5177
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5874	20.3763	20.5757	20.7955	20.9071	20.9432	20.9470	20.9469	20.9323	20.7849	20.4637	20.2928 (87)
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819 (88)
util rest of house	0.9908	0.9736	0.9361	0.8313	0.6576	0.4464	0.3032	0.3364	0.5629	0.8644	0.9751	0.9930 (89)
MIT 2	19.8856	19.7042	19.9005	20.1200	20.2163	20.2597	20.2617	20.2654	20.2460	20.1177	19.8071	19.6246 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.9740	19.7888	19.9855	20.2050	20.3033	20.3458	20.3480	20.3512	20.3324	20.2017	19.8898	19.7087 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9740	19.7888	19.9855	20.2050	20.3033	20.3458	20.3480	20.3512	20.3324	20.2017	19.8898	19.7087 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9899	0.9697	0.9309	0.8277	0.6581	0.4488	0.3059	0.3392	0.5650	0.8604	0.9715	0.9917 (94)
Useful gains	1073.0989	1275.7902	1363.8830	1330.4921	1108.0421	744.4933	487.7533	511.0693	806.8367	1085.5140	1068.7594	1014.8953 (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	2190.9750	2070.2666	1865.2130	1522.0415	1151.9623	748.2105	488.0617	511.6208	820.7465	1285.6460	1731.3469	2122.2336 (97)
Space heating kWh	831.6998	533.8881	372.9896	137.9156	32.6767	0.0000	0.0000	0.0000	0.0000	148.8982	477.0630	823.8597 (98a)
Space heating requirement - total per year (kWh/year)												3358.9906
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	831.6998	533.8881	372.9896	137.9156	32.6767	0.0000	0.0000	0.0000	0.0000	148.8982	477.0630	823.8597 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3358.9906
Space heating per m2										(98c) / (4) =		18.8316 (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 %)												391.5114 (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	831.6998	533.8881	372.9896	137.9156	32.6767	0.0000	0.0000	0.0000	0.0000	148.8982	477.0630	823.8597 (98)
Space heating efficiency (main heating system 1)	391.5114	391.5114	391.5114	391.5114	391.5114	0.0000	0.0000	0.0000	0.0000	391.5114	391.5114	391.5114 (210)
Space heating fuel (main heating system)	212.4331	136.3659	95.2692	35.2265	8.3463	0.0000	0.0000	0.0000	0.0000	38.0316	121.8516	210.4306 (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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495 (64)
Efficiency of water heater (217)m	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454 (216)
Fuel for water heating, kWh/month	173.9453	153.9248	163.6200	143.9264	139.5996	125.8668	124.2048	129.0447	130.3733	145.3016	154.4335	172.0408 (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	49.1623	44.4046	49.1623	47.5764	49.1623	47.5764	49.1623	49.1623	47.5764	49.1623	47.5764	49.1623 (221)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-121.7162	-162.3203	-218.2644	-226.3860	-232.6342	-213.6229	-211.6034	-204.4026	-188.9260	-172.9657	-129.3627	-106.4056 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												857.9548 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.0454
Water heating fuel used												1756.2815 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)	
mechanical ventilation fans (SFP = 1.0640)	578.8463 (230a)
Total electricity for the above, kWh/year	578.8463 (231)
Electricity for lighting (calculated in Appendix L)	325.0287 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2188.6100 (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	1329.5013 (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	857.9548	0.1574	135.0325 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1756.2815	0.1409	247.3960 (264)
Space and water heating			382.4285 (265)
Pumps, fans and electric keep-hot	578.8463	0.1387	80.2931 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2188.6100	0.1360	-297.7524
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-297.7524 (269)
Total CO2, kg/year			211.8809 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.1900 (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	857.9548	1.5826	1357.8133 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1756.2815	1.5209	2671.0590 (278)
Space and water heating			4028.8723 (279)
Pumps, fans and electric keep-hot	578.8463	1.5128	875.6787 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2188.6100	1.5029	-3289.2300
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3289.2300 (283)
Total Primary energy kWh/year			2113.8609 (286)
Dwelling Primary energy Rate (DPER)			11.8500 (287)

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

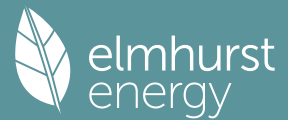
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0897 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3397 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3397 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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													
Effective ac	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991	(22b)
	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580		(27)
Heatloss Floor 1			88.6200	0.1300	11.5206		(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322		(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306		(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725		(30)
Total net area of external elements Aum(A, m ²)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	90.2139	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.7565 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				20.5100	0.0500	1.0255	
E3 Sill				11.8900	0.0500	0.5945	
E4 Jamb				32.7900	0.0500	1.6395	
E5 Ground floor (normal)				39.3500	0.1600	6.2960	
E6 Intermediate floor within a dwelling				41.2600	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)				15.8900	0.0600	0.9534	
E12 Gable (insulation at ceiling level)				19.8400	0.0600	1.1904	
E13 Gable (insulation at rafter level)				6.2000	0.0800	0.4960	
E16 Corner (normal)				25.7100	0.0900	2.3139	
E17 Corner (inverted - internal area greater than external area)				5.1400	-0.0900	-0.4626	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0466 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	104.2605 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 87.3802	Feb 86.8442	Mar 86.3189	Apr 83.8513	May 83.3896	Jun 81.2404	Jul 81.2404	Aug 80.8424	Sep 82.0683	Oct 83.3896	Nov 84.3236	Dec 85.3000	(38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605	(39)
Average = Sum(39)m / 12 =												188.1096	
HLP	Jan 1.0744	Feb 1.0714	Mar 1.0684	Apr 1.0546	May 1.0520	Jun 1.0400	Jul 1.0400	Aug 1.0377	Sep 1.0446	Oct 1.0520	Nov 1.0573	Dec 1.0627	(40)
HLP (average)												1.0546	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

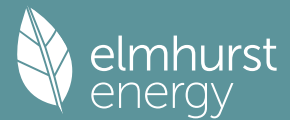
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	73.7947	(42a)
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	31.8713	(42b)
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	45.0834	(42c)
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use	Jan 151.1413	Feb 147.9137	Mar 143.9833	Apr 138.0069	May 133.1535	Jun 127.9358	Jul 125.9309	Aug 129.8443	Sep 133.9717	Oct 139.4493	Nov 145.5178	Dec 150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m													
35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	35.4056	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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	290.2970	256.6249	272.2230	238.2078	230.1763	206.5953	203.2285	211.7005	214.4838	240.1575	256.6001	286.9632	(62)
WWHRS	-33.8656	-29.9510	-31.3630	-25.9698	-24.2029	-20.7106	-19.4129	-20.6437	-21.4280	-25.2612	-28.6179	-33.2385	(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	256.4314	226.6739	240.8600	212.2380	205.9734	185.8847	183.8156	191.0568	193.0558	214.8962	227.9822	253.7247	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2592.5928	(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	120.3317	106.8317	114.3221	102.2440	100.3416	91.7329	91.3814	94.1984	94.3558	103.6603	108.3595	119.2232	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan 148.6836	Feb 148.6836	Mar 148.6836	Apr 148.6836	May 148.6836	Jun 148.6836	Jul 148.6836	Aug 148.6836	Sep 148.6836	Oct 148.6836	Nov 148.6836	Dec 148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500 (68)
Pumps, fans	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Total internal gains	161.7361	158.9758	153.6587	142.0056	134.8677	127.4068	122.8245	126.6107	131.0497	139.3284	150.4993	160.2462 (72)
	761.7569	781.8523	748.1592	723.0032	685.2898	657.6941	631.6884	631.8428	651.4147	676.1963	717.9426	744.8244 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	14.4500	10.6334	0.6300	0.7000	0.7700	46.9582 (74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012 (76)
South	18.2000	46.7521	0.6300	0.7000	0.7700	260.0423 (78)

Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1071.7586	1303.3450	1452.8157	1595.1823	1671.4547	1643.4928	1579.0895	1491.3879	1412.7050	1249.3398	1087.8525	1011.1396 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062	50.6440
util living area	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937	4.3763
	0.9942	0.9861	0.9703	0.9267	0.8323	0.6655	0.5033	0.5498	0.7756	0.9447	0.9876	0.9955 (86)
MIT	19.4129	19.6672	19.9922	20.4042	20.7355	20.9300	20.9839	20.9764	20.8578	20.4237	19.8455	19.3765 (87)
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359	20.0314 (88)
util rest of house	0.9927	0.9826	0.9624	0.9068	0.7874	0.5858	0.4009	0.4459	0.7057	0.9256	0.9839	0.9943 (89)
MIT 2	18.1625	18.4876	18.8998	19.4164	19.8015	20.0038	20.0435	20.0414	19.9397	19.4504	18.7246	18.1226 (90)
Living area fraction	18.3200	18.6361	19.0373	19.5408	19.9191	20.1205	20.1619	20.1591	20.0553	19.5730	18.8658	18.2805 (91)
MIT	18.3200	18.6361	19.0373	19.5408	19.9191	20.1205	20.1619	20.1591	20.0553	19.5730	18.8658	18.2805 (92)
Temperature adjustment	18.3200	18.6361	19.0373	19.5408	19.9191	20.1205	20.1619	20.1591	20.0553	19.5730	18.8658	18.2805 (93)
adjusted MIT	18.3200	18.6361	19.0373	19.5408	19.9191	20.1205	20.1619	20.1591	20.0553	19.5730	18.8658	18.2805 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9888	0.9755	0.9518	0.8942	0.7810	0.5921	0.4133	0.4581	0.7065	0.9136	0.9773	0.9911 (94)
Ext temp.	1059.7314	1271.3548	1382.8188	1426.4099	1305.3950	973.1666	652.7148	683.2218	998.0143	1141.4385	1063.1246	1002.1125 (95)
Heat loss rate W	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)
Space heating kWh	2686.7943	2625.0418	2389.3561	2001.6596	1542.3229	1024.0492	660.7424	695.8272	1109.6476	1683.7827	2218.8363	2669.1045 (97)
Space heating requirement - total per year (kWh/year)	1210.5348	909.6776	748.8638	414.1798	176.2744	0.0000	0.0000	0.0000	0.0000	403.5041	832.1124	1240.2420 (98a)
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)	1210.5348	909.6776	748.8638	414.1798	176.2744	0.0000	0.0000	0.0000	0.0000	403.5041	832.1124	1240.2420 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1210.5348	909.6776	748.8638	414.1798	176.2744	0.0000	0.0000	0.0000	0.0000	403.5041	832.1124	1240.2420 (98c)
Space heating per m ²	(98c) / (4) =											33.2757 (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 %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1210.5348	909.6776	748.8638	414.1798	176.2744	0.0000	0.0000	0.0000	0.0000	0.0000	403.5041	832.1124	1240.2420 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1311.5220	985.5662	811.3367	448.7322	190.9799	0.0000	0.0000	0.0000	0.0000	437.1659	901.5302	1343.7075 (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	256.4314	226.6739	240.8600	212.2380	205.9734	185.8847	183.8156	191.0568	193.0558	214.8962	227.9822	253.7247 (64)
Water heating requirement	87.0832	86.8462	86.4278	85.5317	83.7126	79.8000	79.8000	79.8000	79.8000	85.4510	86.6972	79.8000 (216)
Efficiency of water heater (217)m	294.4672	261.0061	278.6834	248.1397	246.0483	232.9383	230.3454	239.4196	241.9245	251.4848	262.9637	291.1989 (219)
Fuel for water heating, kWh/month	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)
Space cooling fuel requirement (221)m	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)
Pumps and Fa	37.2806	29.9079	26.9287	19.7291	15.2393	12.4507	13.9018	18.0701	23.4713	30.7956	34.7836	38.3167 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)												

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(233a)m	-75.4014	-102.6818	-142.5704	-154.5687	-161.8547	-149.1948	-147.1295	-141.0701	-129.9310	-114.4155	-81.5024	-65.6023	(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	-54.3557	-112.7574	-221.3379	-328.5901	-430.9550	-431.9160	-427.0296	-363.3355	-268.5563	-160.1892	-72.1962	-43.1238	(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												6430.5406	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3078.6198	(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)												300.8756	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4380.2655	(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												5515.7705	(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	6430.5406	0.2100	1350.4135 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3078.6198	0.2100	646.5102 (264)
Space and water heating			1996.9237 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	300.8756	0.1443	43.4256 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1465.9227	0.1354	-198.4477
PV Unit electricity exported	-2914.3428	0.1262	-367.8831
Total			-566.3308 (269)
Total CO2, kg/year			1485.9478 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3300 (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	6430.5406	1.1300	7266.5109 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3078.6198	1.1300	3478.8404 (278)
Space and water heating			10745.3513 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	300.8756	1.5338	461.4930 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1465.9227	1.5004	-2199.4159
PV Unit electricity exported	-2914.3428	0.4634	-1350.4256
Total			-3549.8415 (283)
Total Primary energy kWh/year			7787.1036 (286)
Target Primary Energy Rate (TPER)			43.6600 (287)

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

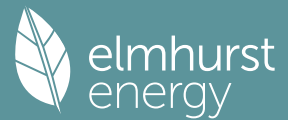
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)

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Number of open flues
Number of chimneys / flues attached to closed fire
Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6b)
0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Air changes per hour
Blower Door
Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
(21) = (18) x (20) = 0.2897 (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
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
Adj infilt rate	0.3694	0.3621	0.3549	0.3187	0.3114	0.2752	0.2752	0.2680	0.2897	0.3114	0.3259	0.3404
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579

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
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983		
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500
Total net area of external elements Aum(A, m2)			382.9800				
Fabric heat loss, W/K = Sum (A x U)					80.1680		

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
List of Thermal Bridges

(28)...(30) + (32) = 80.1680
(28)...(30) + (32) + (32a)...(32e) = 34560.3500
193.7565

	Length	Psi-value	Total
K1 Element	20.5100	0.0230	0.4717
E2 Other lintels (including other steel lintels)	11.8900	0.0200	0.2378
E3 Sill	32.7900	0.0160	0.5246
E4 Jamb	39.3500	0.0620	2.4397
E5 Ground floor (normal)	41.2600	0.0010	0.0413
E6 Intermediate floor within a dwelling	15.8900	0.0670	1.0646
E10 Eaves (insulation at ceiling level)	19.8400	0.0550	1.0912
E12 Gable (insulation at ceiling level)	6.2000	0.0400	0.2480
E13 Gable (insulation at rafter level)	25.7100	0.0400	1.0284
E16 Corner (normal)	5.1400	-0.0700	-0.3598
E17 Corner (inverted - internal area greater than external area)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss

(36a) = 0.0000
(33) + (36) + (36a) = 86.9555

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
Jan 83.6161 Feb 83.2263 Mar 82.8442 Apr 81.0495 May 80.7138 Jun 79.1507 Jul 79.1507 Aug 78.8612 Sep 79.7528 Oct 80.7138 Nov 81.3930 Dec 82.1032
Heat transfer coeff 170.5716 170.1818 169.7997 168.0051 167.6693 166.1062 166.1062 165.8167 166.7083 167.6693 168.3486 169.0587
Average = Sum(39)m / 12 = 168.0035

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9563	0.9541	0.9520	0.9419	0.9400	0.9312	0.9312	0.9296	0.9346	0.9400	0.9438	0.9478
HLP (average)												0.9419
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

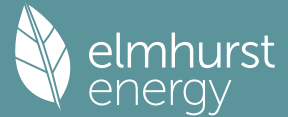
4. Water heating energy requirements (kWh/year)

Assumed occupancy
Hot water usage for mixer showers
Hot water usage for baths
Hot water usage for other uses
Average daily hot water use (litres/day)

2.9737 (42)
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)
31.9794 31.5045 30.8357 29.6025 28.6791 27.6552 27.1022 27.7663 28.4894 29.5850 30.8436 31.8713 (42b)
45.0834 43.4440 41.8046 40.1652 38.5258 36.8864 36.8864 38.5258 40.1652 41.8046 43.4440 45.0834 (42c)
70.6348 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547
Energy conte	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924
Energy content (annual)												
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
Water storage 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
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
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
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
Total heat required for water heating calculated for each month	103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186
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
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
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
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
Output from w/h												

Full SAP Calculation Printout



103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186 (64)
Total per year (kWh/year)											997.1298 (64)
Electric shower(s)											997 (64)
59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											674.8135 (64a)
Heat gains from water heating, kWh/month											
40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358 (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
(66)m	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
	179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
	349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684 (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 (70)
Losses e.g. evaporation (negative values) (Table 5)											
	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Water heating gains (Table 5)											
	54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011 (72)
Total internal gains											
	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445 (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	14.4500	10.6334	0.6300	0.7000	0.7700	46.9582 (74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012 (76)
South	18.2000	46.7521	0.6300	0.7000	0.7700	260.0423 (78)
Solar gains						
	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987
Total gains						
	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											
Utilisation factor for gains for living area, nil,m (see Table 9a)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
tau	56.2819	56.4108	56.5378	57.1417	57.2561	57.7949	57.7949	57.8958	57.5862	57.2561	57.0251
alpha	4.7521	4.7607	4.7692	4.8094	4.8171	4.8530	4.8530	4.8597	4.8391	4.8171	4.8017
util living area											
	0.9962	0.9891	0.9736	0.9271	0.8231	0.6443	0.4804	0.5291	0.7651	0.9491	0.9908
MIT	19.5562	19.8093	20.1207	20.5061	20.8004	20.9546	20.9910	20.9859	20.8957	20.5029	19.9554
Th 2	20.1199	20.1218	20.1236	20.1320	20.1336	20.1410	20.1410	20.1424	20.1382	20.1336	20.1304
util rest of house											
	0.9952	0.9863	0.9668	0.9081	0.7797	0.5710	0.3903	0.4364	0.6990	0.9319	0.9881
MIT 2	18.7900	19.0427	19.3510	19.7281	19.9929	20.1175	20.1381	20.1374	20.0768	19.7326	19.1958
Living area fraction											
	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915
Temperature adjustment											
	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915
adjusted MIT											
	18.8865	19.1393	19.4479	19.8261	20.0946	20.2229	20.2455	20.2442	20.1799	19.8296	19.2915

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Utilisation	0.9933	0.9822	0.9602	0.9002	0.7775	0.5784	0.4015	0.4477	0.7025	0.9244	0.9844
Useful gains	955.3420	1173.5192	1293.7529	1348.1001	1227.1297	901.1285	601.0507	629.9280	931.3379	1066.8272	969.9318
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W											
	2488.0439	2423.2642	2198.5471	1835.6324	1407.5178	933.9917	605.5342	637.4347	1013.5745	1547.5234	2052.4144
Space heating kWh											
	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875
Space heating requirement - total per year (kWh/year)											
	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875
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
Solar heating contribution - total per year (kWh/year)											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh											
	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875
Space heating requirement after solar contribution - total per year (kWh/year)											
	1140.3302	839.8286	673.1669	351.0233	134.2088	0.0000	0.0000	0.0000	0.0000	357.6380	779.3875
Space heating per m2											

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W											
	0.0000	0.0000	0.0000	0.0000	0.0000	1561.3983	1229.1859	1260.2073	0.0000	0.0000	0.0000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8706	0.9286	0.9063	0.0000	0.0000	0.0000
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1359.2843	1141.4221	1142.1362	0.0000	0.0000	0.0000
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1739.0773	1671.0936	1569.6809	0.0000	0.0000	0.0000
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	273.4510	394.0755	318.0932	0.0000	0.0000	0.0000
Cooled fraction											
Intermittency factor (Table 10b)											

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Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	68.3627	98.5189	79.5233	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												246.4049 (107)
Energy for space cooling												30.5569 (99)
Total												1.3814 (108)
Fabric Energy Efficiency (DFEE)												31.9383 (109)
												31.9 (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)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (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)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0897 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3397	(18)
Number of sides sheltered		0	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3397	(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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3991 (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	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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
TER Opening Type (Uw = 1.20)			33.1500	1.1450	37.9580		(27)
Heatloss Floor 1			88.6200	0.1300	11.5206		(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322		(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306		(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725		(30)
Total net area of external elements Aum(A, m2)			382.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.2139		(33)

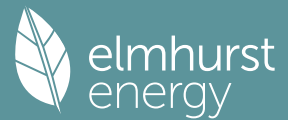
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	20.5100	0.0500	1.0255
E2 Other lintels (including other steel lintels)	11.8900	0.0500	0.5945
E3 Sill	32.7900	0.0500	1.6395
E4 Jamb	39.3500	0.1600	6.2960
E5 Ground floor (normal)	41.2600	0.0000	0.0000
E6 Intermediate floor within a dwelling	15.8900	0.0600	0.9534
E10 Eaves (insulation at ceiling level)	19.8400	0.0600	1.1904
E12 Gable (insulation at ceiling level)	6.2000	0.0800	0.4960
E13 Gable (insulation at rafter level)	25.7100	0.0900	2.3139
E16 Corner (normal)	5.1400	-0.0900	-0.4626
E17 Corner (inverted - internal area greater than external area)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.0466	(36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	104.2605	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	87.3802	86.8442	86.3189	83.8513	83.3896	81.2404	81.2404	80.8424	82.0683	83.3896	84.3236	85.3000 (38)
Heat transfer coeff	191.6407	191.1047	190.5794	188.1118	187.6501	185.5009	185.5009	185.1029	186.3288	187.6501	188.5841	189.5605 (39)
Average = Sum(39)m / 12 =												188.1096

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0744	1.0714	1.0684	1.0546	1.0520	1.0400	1.0400	1.0377	1.0446	1.0520	1.0573	1.0627	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (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	0.0000	(42a)
Hot water usage for baths													
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713		(42b)
Hot water usage for other uses													
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834		(42c)
Average daily hot water use (litres/day)												70.6348	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
77.0628	74.9485	72.6402	69.7677	67.2049	64.5416	63.9886	66.2921	68.6546	71.3896	74.2876	76.9547		(44)
Energy conte	122.0486	106.7256	111.6453	95.5085	90.4707	79.3614	77.3886	82.0835	84.6580	96.8750	105.8362	120.4924	(45)
Energy content (annual)										Total = Sum(45)m =		1173.0939	
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	0.0000	(46)
Water storage 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	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	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													
103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186		(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													
103.7413	90.7168	94.8985	81.1822	76.9001	67.4572	65.7803	69.7709	71.9593	82.3438	89.9608	102.4186		(64)
12Total per year (kWh/year)												997	(64)
Electric shower(s)													
59.3246	52.8587	57.7197	55.0812	56.1147	53.5280	55.3123	56.1147	55.0812	57.7197	56.6343	59.3246		(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												674.8135	(64a)
Heat gains from water heating, kWh/month													
40.7665	35.8939	38.1545	34.0658	33.2537	30.2463	30.2732	31.4714	31.7601	35.0159	36.6488	40.4358		(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	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	148.6836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
179.4231	198.6470	179.4231	185.4038	179.4231	185.4038	179.4231	179.4231	185.4038	179.4231	185.4038	179.4231		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
349.9926	353.6244	344.4723	324.9886	300.3939	277.2784	261.8358	258.2040	267.3561	286.8398	311.4345	334.5500		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684	37.8684		(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)													
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468		(71)
Water heating gains (Table 5)													
54.7936	53.4135	51.2830	47.3137	44.6958	42.0088	40.6897	42.3003	44.1113	47.0643	50.9011	54.3492		(72)
Total internal gains	651.8144	673.2900	642.7835	625.3112	592.1179	572.2961	549.5537	547.5324	564.4762	580.9322	615.3445	635.9273	(73)

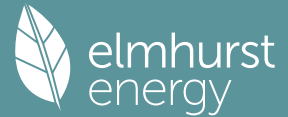
6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
North					14.4500	10.6334	0.6300	0.7000	0.7700		46.9582 (74)	
East					0.5000	19.6403	0.6300	0.7000	0.7700		3.0012 (76)	
South					18.2000	46.7521	0.6300	0.7000	0.7700		260.0423 (78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	961.8161	1194.7827	1347.4399	1497.4903	1578.2828	1558.0948	1496.9547	1407.0775	1325.7666	1154.0758	985.2544	902.2425 (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	50.0942	50.2347	50.3732	51.0340	51.1596	51.7523	51.7523	51.8636	51.5224	51.1596	50.9062	50.6440
alpha	4.3396	4.3490	4.3582	4.4023	4.4106	4.4502	4.4502	4.4576	4.4348	4.4106	4.3937	4.3763
util living area	0.9962	0.9899	0.9771	0.9395	0.8537	0.6920	0.5279	0.5779	0.8033	0.9572	0.9915	0.9971 (86)
MIT	19.3330	19.5910	19.9230	20.3509	20.7027	20.9183	20.9806	20.9713	20.8348	20.3672	19.7727	19.2968 (87)
Th 2	20.0218	20.0243	20.0267	20.0381	20.0402	20.0502	20.0502	20.0520	20.0463	20.0402	20.0359	20.0314 (88)
util rest of house	0.9952	0.9873	0.9709	0.9223	0.8117	0.6122	0.4219	0.4707	0.7363	0.9416	0.9888	0.9964 (89)
MIT 2	18.4935	18.7516	19.0814	19.5048	19.8281	20.0073	20.0438	20.0418	19.9476	19.5285	18.9423	18.4645 (90)
Living area fraction									fLA = Living area / (4) =			0.1259 (91)
MIT	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5992	18.8573	19.1874	19.6114	19.9382	20.1220	20.1618	20.1588	20.0594	19.6341	19.0469	18.5693 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9830	0.9638	0.9130	0.8066	0.6187	0.4348	0.4834	0.7373	0.9331	0.9850	0.9947	(94)
Useful gains	955.1524	1174.4412	1298.6550	1367.1440	1273.0918	963.9179	650.9079	680.2006	977.5128	1076.8644	970.4435	897.4369	(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	2740.3067	2667.3032	2417.9584	2014.9352	1545.9004	1024.3351	660.7147	695.7691	1110.3987	1695.2574	2252.9929	2723.8548	(97)
Space heating kWh	1328.1548	1003.2033	832.7618	466.4097	202.9696	0.0000	0.0000	0.0000	0.0000	460.0843	923.4355	1358.8549	(98a)
Space heating requirement - total per year (kWh/year)												6575.8739	
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	1328.1548	1003.2033	832.7618	466.4097	202.9696	0.0000	0.0000	0.0000	0.0000	460.0843	923.4355	1358.8549	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6575.8739	
Space heating per m2										(98c) / (4) =		36.8665	(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	1743.7088	1372.7069	1406.7823	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8154	0.8869	0.8585	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1421.8749	1217.3980	1207.7434	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1739.0773	1671.0936	1569.6809	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	228.3857	337.5495	269.2815	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	57.0964	84.3874	67.3204	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												208.8042	(107)
Energy for space heating												36.8665	(99)
Energy for space cooling												1.1706	(108)
Total												38.0371	(109)
Fabric Energy Efficiency (TFEE)												38.0	(109)

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

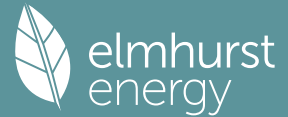
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)
Wind speed	5.1000
Wind factor	1.2750
Adj infilt rate	0.2550
Balanced mechanical ventilation with heat recovery	0.2500
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

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If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.2000 (23c)

Effective ac 0.3590 0.3540 0.3490 0.3240 0.3190 0.2940 0.2940 0.2890 0.3040 0.3190 0.3290 0.3390 (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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.1680			(33)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 34560.3500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Eaves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 86.9555 (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	52.8287	52.0930	51.3572	47.6783	46.9425	43.2636	43.2636	42.5279	44.7352	46.9425	48.4141	49.8856	(38)
Heat transfer coeff	139.7843	139.0485	138.3127	134.6338	133.8980	130.2192	130.2192	129.4834	131.6907	133.8980	135.3696	136.8412	(39)
Average = Sum(39)m / 12 =												134.4499	
HLP	0.7837	0.7796	0.7754	0.7548	0.7507	0.7301	0.7301	0.7259	0.7383	0.7507	0.7589	0.7672	(40)
HLP (average)												0.7538	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

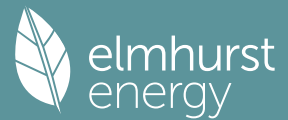
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947	(42a)
Hot water usage for baths	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713	(42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834	(42c)
Average daily hot water use (litres/day)												138.9328	(43)
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)										Total = Sum(45)m =		2307.6445	
Distribution loss (46)m = 0.15 x (45)m	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.3500	(55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(56)
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(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)
Heat gains from water heating, kWh/month	131.6808	117.0825	125.6712	113.2270	111.6906	102.7159	102.7305	105.5474	105.3388	115.0094	119.3424	130.5723	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)

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

Metabolic gains (Table 5), Watts													
(66)m	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(69)

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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)											
Water heating gains (Table 5)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468 (71)
Total internal gains	176.9903	174.2299	168.9129	157.2597	150.1218	142.6609	138.0786	141.8648	146.3038	154.5825	165.7534	175.5004 (72)
	860.6676	858.1834	831.5748	782.7676	732.5683	687.6771	661.3249	664.8349	690.5654	735.9982	790.2305	837.4078 (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	14.4500	10.6334	0.6300	0.7000	0.7700	46.9582 (74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012 (76)
South	18.2000	46.7521	0.6300	0.7000	0.7700	260.0423 (78)

Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152 (83)
Total gains	1170.6692	1379.6761	1536.2313	1654.9467	1718.7332	1673.4757	1608.7260	1524.3800	1451.8557	1309.1418	1160.1404	1103.7230 (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	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770
util living area	0.9893	0.9734	0.9370	0.8451	0.6896	0.4939	0.3556	0.3898	0.6102	0.8775	0.9750	0.9919 (86)
Living	20.2426	20.4097	20.6065	20.8076	20.9102	20.9434	20.9470	20.9469	20.9333	20.7997	20.4953	20.2240
Non living	19.5694	19.7366	19.9292	20.1303	20.2185	20.2598	20.2617	20.2655	20.2466	20.1302	19.8377	19.5635
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6125	20.4097	20.6065	20.8076	20.9102	20.9434	20.9470	20.9469	20.9333	20.7997	20.4953	20.3325 (87)
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819 (88)
util rest of house	0.9868	0.9677	0.9241	0.8177	0.6464	0.4426	0.3005	0.3325	0.5544	0.8489	0.9686	0.9900 (89)
MIT 2	19.9104	19.7366	19.9292	20.1303	20.2185	20.2598	20.2617	20.2655	20.2466	20.1302	19.8377	19.6640 (90)
Living area fraction									fLA = Living area / (4) =			0.1259 (91)
MIT	19.9988	19.8213	20.0145	20.2155	20.3056	20.3459	20.3480	20.3513	20.3330	20.2145	19.9206	19.7482 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9988	19.8213	20.0145	20.2155	20.3056	20.3459	20.3480	20.3513	20.3330	20.2145	19.9206	19.7482 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9858	0.9635	0.9188	0.8145	0.6469	0.4450	0.3032	0.3353	0.5565	0.8453	0.9646	0.9883 (94)
Useful gains	1153.9967	1329.2716	1411.5188	1347.9315	1111.9326	744.6717	487.7695	511.1064	807.9570	1106.5605	1119.1158	1090.7650 (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	2194.4460	2074.7900	1869.2299	1523.4553	1152.2695	748.2246	488.0630	511.6238	820.8346	1287.3588	1735.5130	2127.6274 (97)
Space heating kWh	774.0943	500.9883	340.5370	126.3771	30.0107	0.0000	0.0000	0.0000	0.0000	134.5140	443.8060	771.4257 (98a)
Space heating requirement - total per year (kWh/year)												3121.7531
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	774.0943	500.9883	340.5370	126.3771	30.0107	0.0000	0.0000	0.0000	0.0000	134.5140	443.8060	771.4257 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3121.7531
Space heating per m2										(98c) / (4) =		17.5016 (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 %)												391.5114 (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	774.0943	500.9883	340.5370	126.3771	30.0107	0.0000	0.0000	0.0000	0.0000	134.5140	443.8060	771.4257 (98)
Space heating efficiency (main heating system 1)	391.5114	391.5114	391.5114	391.5114	391.5114	0.0000	0.0000	0.0000	0.0000	391.5114	391.5114	391.5114 (210)
Space heating fuel (main heating system)	197.7195	127.9627	86.9801	32.2793	7.6653	0.0000	0.0000	0.0000	0.0000	34.3576	113.3571	197.0379 (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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495 (64)
Efficiency of water heater (217)m	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454 (216)
Fuel for water heating, kWh/month	173.9453	153.9248	163.6200	143.9264	139.5996	125.8668	124.2048	129.0447	130.3733	145.3016	154.4335	172.0408 (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	49.1623	44.4046	49.1623	47.5764	49.1623	47.5764	49.1623	49.1623	47.5764	49.1623	47.5764	49.1623 (231)

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Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-121.2180	-161.6883	-217.1921	-225.7985	-232.4610	-213.6229	-211.6034	-204.4026	-188.9260	-172.5180	-128.9068	-106.0293	(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												797.3595	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.0454	
Water heating fuel used												1756.2815	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)													
mechanical ventilation fans (SFP = 1.0640)												578.8463	(230a)
Total electricity for the above, kWh/year												578.8463	(231)
Electricity for lighting (calculated in Appendix L)												325.0287	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2184.3670	(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												1273.1490	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	797.3595	16.4900	131.4846	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1756.2815	16.4900	289.6108	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	578.8463	16.4900	95.4518	(249)
Energy for lighting	325.0287	16.4900	53.5972	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2184.3670	16.4900	-360.2021	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-360.2021	(252)
Total energy cost			209.9423	(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] =	0.3384	(257)
SAP value		94.5152	
SAP rating (Section 12)		95	(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	797.3595	0.1575	125.5448	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1756.2815	0.1409	247.3960	(264)
Space and water heating			372.9407	(265)
Pumps, fans and electric keep-hot	578.8463	0.1387	80.2931	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2184.3670	0.1360	-297.1080	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-297.1080	(269)
Total CO2, kg/year			203.0375	(272)
CO2 emissions per m2			1.1400	(273)
EI value			98.7820	
EI rating			99	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 445.9250 (5)

2. Ventilation rate

	m ³ 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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)
Wind speed	Jan 5.1000 Feb 4.7000 Mar 4.6000 Apr 4.3000 May 4.3000 Jun 4.0000 Jul 4.0000 Aug 3.9000 Sep 4.0000 Oct 4.5000 Nov 4.4000 Dec 4.7000 (22)
Wind factor	1.2750 1.1750 1.1500 1.0750 1.0750 1.0000 1.0000 0.9750 1.0000 1.1250 1.1000 1.1750 (22a)
Adj infilt rate	0.2550 0.2350 0.2300 0.2150 0.2150 0.2000 0.2000 0.1950 0.2000 0.2250 0.2200 0.2350 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.2000 (23c)
Effective ac	0.3590 0.3390 0.3340 0.3190 0.3190 0.3040 0.3040 0.2990 0.3040 0.3290 0.3240 0.3390 (25)

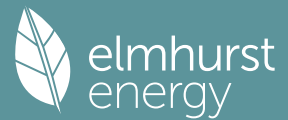
3. Heat losses and heat loss parameter

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					
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)				
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)				
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)				
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)				
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)				
Total net area of external elements Aum(A, m2)			382.9800					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.1680			(33)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		34560.3500	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.7565	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value		Total					
E2 Other lintels (including other steel lintels)				20.5100	0.0230		0.4717					
E3 Sill				11.8900	0.0200		0.2378					
E4 Jamb				32.7900	0.0160		0.5246					
E5 Ground floor (normal)				39.3500	0.0620		2.4397					
E6 Intermediate floor within a dwelling				41.2600	0.0010		0.0413					
E10 Eaves (insulation at ceiling level)				15.8900	0.0670		1.0646					
E12 Gable (insulation at ceiling level)				19.8400	0.0550		1.0912					
E13 Gable (insulation at rafter level)				6.2000	0.0400		0.2480					
E16 Corner (normal)				25.7100	0.0400		1.0284					
E17 Corner (inverted - internal area greater than external area)				5.1400	-0.0700		-0.3598					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.7876 (36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss						(33) + (36) + (36a) =		86.9555 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.8287	Feb 49.8856	Mar 49.1499	Apr 46.9425	May 46.9425	Jun 44.7352	Jul 44.7352	Aug 43.9994	Sep 44.7352	Oct 48.4141	Nov 47.6783	Dec 49.8856 (38)
Heat transfer coeff	139.7843	136.8412	136.1054	133.8980	133.8980	131.6907	131.6907	130.9549	131.6907	135.3696	134.6338	136.8412 (39)
Average = Sum(39)m / 12 =												134.4499
HLP	Jan 0.7837	Feb 0.7672	Mar 0.7631	Apr 0.7507	May 0.7507	Jun 0.7383	Jul 0.7383	Aug 0.7342	Sep 0.7383	Oct 0.7589	Nov 0.7548	Dec 0.7672 (40)
HLP (average)												0.7538
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.9737 (42)
Hot water usage for mixer showers											
74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947 (42a)
Hot water usage for baths											
31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713 (42b)
Hot water usage for other uses											
45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834 (42c)
Average daily hot water use (litres/day)											138.9328 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494	(44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371	(45)
Energy content (annual)	Total = Sum(45)m = 2307.6445												
Distribution loss	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.5000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(56)
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495	(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	131.6808	117.0825	125.6712	113.2270	111.6906	102.7159	102.7305	105.5474	105.3388	115.0094	119.3424	130.5723	(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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)	176.9903	174.2299	168.9129	157.2597	150.1218	142.6609	138.0786	141.8648	146.3038	154.5825	165.7534	175.5004	(72)
Total internal gains	860.6676	858.1834	831.5748	782.7676	732.5683	687.6771	661.3249	664.8349	690.5654	735.9982	790.2305	837.4078	(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				14.4500	13.8645		0.6300	0.7000	0.7700		61.2273 (74)		
East				0.5000	25.9136		0.6300	0.7000	0.7700		3.9598 (76)		
South				18.2000	58.2505		0.6300	0.7000	0.7700		323.9985 (78)		
Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426	(83)
Total gains	1249.8532	1417.6986	1586.2171	1742.4691	1778.2640	1823.3176	1724.8536	1643.1953	1557.6620	1386.8433	1250.3053	1156.7504	(84)

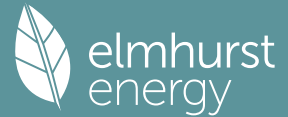
7. Mean internal temperature (heating season)

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	68.6780	70.1550	70.5343	71.6971	71.6971	72.8988	72.8988	73.3084	72.8988	70.9177	71.3052	70.1550	
alpha	5.5785	5.6770	5.7023	5.7798	5.7798	5.8599	5.8599	5.8872	5.8599	5.7278	5.7537	5.6770	
util living area	0.9804	0.9619	0.9103	0.7907	0.6153	0.4033	0.2824	0.2947	0.5025	0.8020	0.9479	0.9852	(86)
Living	20.3744	20.5080	20.6933	20.8569	20.9279	20.9457	20.9469	20.9471	20.9426	20.8659	20.6389	20.3574	
Non living	19.6996	19.8418	20.0204	20.1754	20.2312	20.2536	20.2541	20.2580	20.2520	20.1788	19.9791	19.6957	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6800	20.5080	20.6933	20.8569	20.9279	20.9457	20.9469	20.9471	20.9426	20.8659	20.6389	20.4473	(87)
Th 2	20.2675	20.2819	20.2855	20.2963	20.2963	20.3071	20.3071	20.3107	20.3071	20.2891	20.2927	20.2819	(88)
util rest of house	0.9758	0.9537	0.8927	0.7579	0.5688	0.3539	0.2296	0.2399	0.4464	0.7612	0.9350	0.9816	(89)
MIT 2	19.9770	19.8418	20.0204	20.1754	20.2312	20.2536	20.2541	20.2580	20.2520	20.1788	19.9791	19.7777	(90)
Living area fraction	20.0655	19.9257	20.1051	20.2613	20.3189	20.3407	20.3414	20.3448	20.3390	20.2653	20.0622	19.8620	(92)
MIT	20.0655	19.9257	20.1051	20.2613	20.3189	20.3407	20.3414	20.3448	20.3390	20.2653	20.0622	19.8620	(93)
Temperature adjustment	20.0655	19.9257	20.1051	20.2613	20.3189	20.3407	20.3414	20.3448	20.3390	20.2653	20.0622	19.8620	(93)
adjusted MIT	20.0655	19.9257	20.1051	20.2613	20.3189	20.3407	20.3414	20.3448	20.3390	20.2653	20.0622	19.8620	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9743	0.9489	0.8878	0.7561	0.5704	0.3563	0.2322	0.2426	0.4490	0.7597	0.9300	0.9791	(94)
Useful gains	1217.7493	1345.3118	1408.1770	1317.5446	1014.2570	649.6498	400.4599	398.6537	699.4322	1053.6429	1162.8392	1132.5670	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)

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Heat loss rate W	2050.0044	1946.6623	1742.8417	1427.5206	1033.5467	650.6490	400.5190	398.7260	703.0947	1145.9451	1570.1218	1965.3143 (97)
Space heating kWh	619.1979	404.1076	248.9905	79.1827	14.3516	0.0000	0.0000	0.0000	0.0000	68.6729	293.2435	619.5640 (98a)
Space heating requirement - total per year (kWh/year)												2347.3108
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	619.1979	404.1076	248.9905	79.1827	14.3516	0.0000	0.0000	0.0000	0.0000	68.6729	293.2435	619.5640 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2347.3108
Space heating per m2										(98c) / (4) =		13.1598 (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 %)												391.5114 (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	619.1979	404.1076	248.9905	79.1827	14.3516	0.0000	0.0000	0.0000	0.0000	68.6729	293.2435	619.5640 (98)
Space heating efficiency (main heating system 1)	391.5114	391.5114	391.5114	391.5114	391.5114	0.0000	0.0000	0.0000	0.0000	391.5114	391.5114	391.5114 (210)
Space heating fuel (main heating system)	158.1558	103.2173	63.5973	20.2249	3.6657	0.0000	0.0000	0.0000	0.0000	17.5405	74.9004	158.2493 (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	304.4833	269.4384	286.4094	251.9365	244.3627	220.3240	217.4149	225.8868	228.2125	254.3438	270.3288	301.1495 (64)
Efficiency of water heater	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454 (216)
Fuel for water heating, kWh/month	173.9453	153.9248	163.6200	143.9264	139.5996	125.8668	124.2048	129.0447	130.3733	145.3016	154.4335	172.0408 (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	49.1623	44.4046	49.1623	47.5764	49.1623	47.5764	49.1623	49.1623	47.5764	49.1623	47.5764	49.1623 (231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-143.5525	-169.2964	-224.2720	-233.8680	-236.7540	-223.8223	-219.9968	-214.9309	-201.0999	-184.7555	-148.8469	-122.0281 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												599.5511 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.0454
Water heating fuel used												1756.2815 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)												
mechanical ventilation fans (SFP = 1.0640)												578.8463 (230a)
Total electricity for the above, kWh/year												578.8463 (231)
Electricity for lighting (calculated in Appendix L)												325.0287 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-2323.2234 (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												936.4842 (238)

10a. Fuel costs - using BEDF prices (547)

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	599.5511	26.0600	156.2430 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1756.2815	26.0600	457.6870 (247)	
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)	
Pumps, fans and electric keep-hot	578.8463	26.0600	150.8474 (249)	
Energy for lighting	325.0287	26.0600	84.7025 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2323.2234	26.0600	-605.4320	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-605.4320 (252)	
Total energy cost			244.0478 (255)	

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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	599.5511	0.1583	94.8907 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1756.2815	0.1409	247.3960 (264)
Space and water heating			342.2866 (265)
Pumps, fans and electric keep-hot	578.8463	0.1387	80.2931 (267)
Energy for lighting	325.0287	0.1443	46.9117 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2323.2234	0.1364	-316.8727
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-316.8727 (269)
Total CO2, kg/year			152.6187 (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	599.5511	1.5859	950.8138 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1756.2815	1.5209	2671.0590 (278)
Space and water heating			3621.8728 (279)
Pumps, fans and electric keep-hot	578.8463	1.5128	875.6787 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2323.2234	1.5042	-3494.5135
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3494.5135 (283)
Total Primary energy kWh/year			1501.5778 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: A 95
Current environmental impact rating: A 99

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:			
N Solar water heating	SAP change	Cost change	CO2 change
	+ 1.0	-£ 76	-37 kg (24.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£76	0.21 kg/m²	A 96
Total Savings	£76	0.21 kg/m²	A 99
Potential energy efficiency rating:			A 96
Potential environmental impact rating:			A 99

Fuel prices for cost data on this page from database revision number 547 TEST (31 May 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

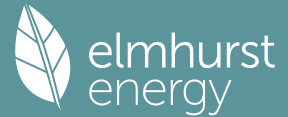
	Current £849	Potential £745	Saving £105
Electricity			
Space heating	£307	£328	-£21
Water heating	£458	£332	£126
Lighting	£85	£85	£0
Generated (PV)	-£605	-£577	-£29
Total cost of fuels	£244	£168	£76
Total cost of uses	£245	£168	£76
Delivered energy	5 kWh/m²	4 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.2 tonnes	0.1 tonnes	0.0 tonnes
CO2 emissions per m²	1 kg/m²	1 kg/m²	0 kg/m²
Primary energy	8 kWh/m²	6 kWh/m²	2 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)
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500 (1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.9250 (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		0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.0000 (17)
Infiltration rate			0.2000 (18)
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2000 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													79.2000 (23c)
Effective ac	0.3590	0.3540	0.3490	0.3240	0.3190	0.2940	0.2940	0.2890	0.3040	0.3190	0.3290	0.3390	(25)

3. Heat losses and heat loss parameter

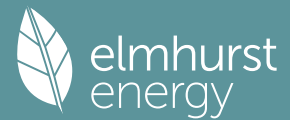
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 80.1680			(33)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								193.7565 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				20.5100	0.0230		0.4717	
E3 Sill				11.8900	0.0200		0.2378	
E4 Jamb				32.7900	0.0160		0.5246	
E5 Ground floor (normal)				39.3500	0.0620		2.4397	
E6 Intermediate floor within a dwelling				41.2600	0.0010		0.0413	
E10 Eaves (insulation at ceiling level)				15.8900	0.0670		1.0646	
E12 Gable (insulation at ceiling level)				19.8400	0.0550		1.0912	
E13 Gable (insulation at rafter level)				6.2000	0.0400		0.2480	
E16 Corner (normal)				25.7100	0.0400		1.0284	
E17 Corner (inverted - internal area greater than external area)				5.1400	-0.0700		-0.3598	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.7876 (36)
Point Thermal bridges								(36a) = 0.0000
Total fabric heat loss								(33) + (36) + (36a) = 86.9555 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	52.8287	52.0930	51.3572	47.6783	46.9425	43.2636	43.2636	42.5279	44.7352	46.9425	48.4141	49.8856 (38)
Heat transfer coeff	139.7843	139.0485	138.3127	134.6338	133.8980	130.2192	130.2192	129.4834	131.6907	133.8980	135.3696	136.8412 (39)
Average = Sum(39)m / 12 =												134.4499
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.7837	0.7796	0.7754	0.7548	0.7507	0.7301	0.7301	0.7259	0.7383	0.7507	0.7589	0.7672 (40)
HLP (average)												0.7538
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9737 (42)
Hot water usage for mixer showers													
	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947 (42a)	
Hot water usage for baths													
	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713 (42b)	
Hot water usage for other uses													
	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834 (42c)	
Average daily hot water use (litres/day)													138.9328 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494 (44)	
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371 (45)	
Energy content (annual)													Total = Sum(45)m = 2307.6445
Distribution loss (46)m = 0.15 x (45)m													
	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056 (46)	

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Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.3500	(55)
Total storage loss													
41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	(56)
If cylinder contains dedicated solar storage													
41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(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													
304.4833	269.4384	285.0136	245.1829	231.5683	207.7173	204.3879	213.7904	222.8096	252.9481	270.3288	301.1495	301.1495	(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)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												639.5215	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												639.5215	
Solar input	-0.0000	-16.1849	-59.1571	-82.0822	-108.3071	-100.1069	-99.5488	-86.4031	-58.9329	-28.7985	-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													
304.4833	253.2535	225.8565	163.1007	123.2612	107.6104	104.8391	127.3873	163.8767	224.1496	270.3288	301.1495	301.1495	(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	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													
131.6808	117.0825	124.5546	107.8241	101.4552	92.6305	92.3089	95.8703	101.0165	113.8928	119.3424	130.5723	130.5723	(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	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900	47.2900	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284	499.3284	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	(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)													
-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	(71)
Water heating gains (Table 5)													
176.9903	174.2299	167.4121	149.7557	136.3645	128.6534	124.0711	128.8579	140.3006	153.0817	165.7534	175.5004	175.5004	(72)
Total internal gains													
860.6676	858.1834	830.0740	775.2636	718.8110	673.6696	647.3174	651.8280	684.5622	734.4974	790.2305	837.4078	837.4078	(73)

6. Solar gains

[Jan]													
	Area		Solar flux		g		FF		Access		Gains		
	m2		Table 6a		Specific data		Specific data		factor		W		
			W/m2		or Table 6b		or Table 6c		Table 6d				
North	14.4500		10.6334		0.6300		0.7000		0.7700		46.9582	(74)	
East	0.5000		19.6403		0.6300		0.7000		0.7700		3.0012	(76)	
South	18.2000		46.7521		0.6300		0.7000		0.7700		260.0423	(78)	
Solar gains	310.0017	521.4927	704.6564	872.1791	986.1649	985.7987	947.4011	859.5451	761.2903	573.1435	369.9099	266.3152	(83)
Total gains	1170.6692	1379.6761	1534.7305	1647.4427	1704.9759	1659.4683	1594.7185	1511.3731	1445.8525	1307.6410	1160.1404	1103.7230	(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	68.6780	69.0414	69.4086	71.3052	71.6971	73.7226	73.7226	74.1415	72.8988	71.6971	70.9177	70.1550		
alpha	5.5785	5.6028	5.6272	5.7537	5.7798	5.9148	5.9148	5.9428	5.8599	5.7798	5.7278	5.6770		
util living area														
0.9893	0.9734	0.9373	0.8471	0.6940	0.4979	0.3587	0.3931	0.6124	0.8779	0.9750	0.9919	0.9919	(86)	
Living	20.2426	20.4097	20.6058	20.8058	20.9090	20.9432	20.9470	20.9469	20.9331	20.7992	20.4953	20.2240		
Non living	19.5694	19.7366	19.9287	20.1287	20.2176	20.2597	20.2617	20.2654	20.2464	20.1298	19.8377	19.5635		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10		
MIT	20.6125	20.4097	20.6058	20.8058	20.9090	20.9432	20.9470	20.9469	20.9331	20.7992	20.4953	20.3325	(87)	
Th 2	20.2675	20.2711	20.2747	20.2927	20.2963	20.3144	20.3144	20.3180	20.3071	20.2963	20.2891	20.2819	(88)	
util rest of house														
0.9868	0.9677	0.9244	0.8199	0.6508	0.4462	0.3031	0.3353	0.5565	0.8494	0.9686	0.9900	0.9900	(89)	
MIT 2	19.9104	19.7366	19.9287	20.1287	20.2176	20.2597	20.2617	20.2654	20.2464	20.1298	19.8377	19.6640	(90)	
Living area fraction									fLA = Living area / (4) =			0.1259	(91)	
MIT	19.9988	19.8213	20.0139	20.2139	20.3047	20.3458	20.3480	20.3513	20.3329	20.2141	19.9206	19.7482	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.9988	19.8213	20.0139	20.2139	20.3047	20.3458	20.3480	20.3513	20.3329	20.2141	19.9206	19.7482	(93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9635	0.9191	0.8166	0.6513	0.4486	0.3059	0.3382	0.5586	0.8457	0.9646	0.9883	(94)
Useful gains	1153.9967	1329.2716	1410.5460	1345.2702	1110.4467	744.5023	487.7538	511.0795	807.6845	1105.9246	1119.1158	1090.7650	(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	2194.4460	2074.7900	1869.1479	1523.2398	1152.1523	748.2112	488.0617	511.6216	820.8132	1287.3071	1735.5130	2127.6274	(97)
Space heating kWh	774.0943	500.9883	341.1998	128.1381	31.0289	0.0000	0.0000	0.0000	0.0000	134.9486	443.8060	771.4257	(98a)
Space heating requirement - total per year (kWh/year)												3125.6297	
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	774.0943	500.9883	341.1998	128.1381	31.0289	0.0000	0.0000	0.0000	0.0000	134.9486	443.8060	771.4257	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3125.6297	
Space heating per m2											(98c) / (4) =	17.5233	(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 %)												391.5114	(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	774.0943	500.9883	341.1998	128.1381	31.0289	0.0000	0.0000	0.0000	0.0000	134.9486	443.8060	771.4257	(98)
Space heating efficiency (main heating system 1)	391.5114	391.5114	391.5114	391.5114	391.5114	0.0000	0.0000	0.0000	0.0000	391.5114	391.5114	391.5114	(210)
Space heating fuel (main heating system)	197.7195	127.9627	87.1494	32.7291	7.9254	0.0000	0.0000	0.0000	0.0000	34.4686	113.3571	197.0379	(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	304.4833	253.2535	225.8565	163.1007	123.2612	107.6104	104.8391	127.3873	163.8767	224.1496	270.3288	301.1495	(64)
Efficiency of water heater (217)m	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	175.0454	(216)
Fuel for water heating, kWh/month	173.9453	144.6787	129.0274	93.1762	70.4167	61.4757	59.8925	72.7738	93.6195	128.0522	154.4335	172.0408	(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	55.9568	50.5416	55.9568	54.1518	55.9568	54.1518	55.9568	55.9568	54.1518	55.9568	54.1518	55.9568	(231)
Lighting	40.2733	32.3087	29.0904	21.3129	16.4627	13.4502	15.0178	19.5207	25.3555	33.2678	37.5759	41.3926	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-121.4494	-161.4523	-213.5216	-216.7479	-215.8222	-196.8933	-194.9265	-191.5932	-182.6221	-171.2415	-129.2603	-106.2212	(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												798.3497	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.0454	
Water heating fuel used												1353.5324	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0640)													
mechanical ventilation fans (SFP = 1.0640)												578.8463	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												658.8463	(231)
Electricity for lighting (calculated in Appendix L)												325.0287	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2101.7513	(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												1034.0058	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	798.3497	16.4900	131.6479	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1353.5324	16.4900	223.1975	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	578.8463	16.4900	95.4518	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	325.0287	16.4900	53.5972	(250)

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Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2101.7513	16.4900	-346.5788
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-346.5788 (252)
Total energy cost			170.5075 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2748 (257)
SAP value		95.5454
SAP rating (Section 12)		96 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	798.3497	0.1574	125.6844	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	1353.5324	0.1450	196.2367	(264)
Space and water heating			321.9211	(265)
Pumps, fans and electric keep-hot	658.8463	0.1387	91.3901	(267)
Energy for lighting	325.0287	0.1443	46.9117	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2101.7513	0.1365	-286.9045	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-286.9045	(269)
Total CO ₂ , kg/year			173.3184	(272)
CO ₂ emissions per m ²			0.9700	(273)
EI value			98.9603	
EI rating			99	(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 (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	88.6200 (1b)	x 2.5000 (2b)	= 221.5500	(1b) - (3b)
First floor	89.7500 (1c)	x 2.5000 (2c)	= 224.3750	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	178.3700			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	445.9250	(5)

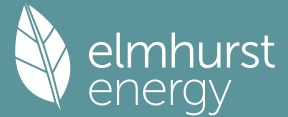
2. Ventilation rate

	m ³ 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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.2550	0.2350	0.2300	0.2150	0.2150	0.2000	0.2000	0.1950	0.2000	0.2250	0.2200	0.2350	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.2000	(23c)
Effective ac	0.3590	0.3390	0.3340	0.3190	0.3190	0.3040	0.3040	0.2990	0.3040	0.3290	0.3240	0.3390	(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	
Glazing (Uw = 0.90)			33.1500	0.8687	28.7983			(27)
Heatloss Floor 1			88.6200	0.1200	10.6344	110.0000	9748.2000	(28a)
Brickwork	106.2400	19.9500	86.2900	0.1800	15.5322	140.0000	12080.6000	(29a)
Render	98.3700	13.2000	85.1700	0.1800	15.3306	140.0000	11923.8000	(29a)
External Roof 1	89.7500		89.7500	0.1100	9.8725	9.0000	807.7500	(30)
Total net area of external elements Aum(A, m2)			382.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...	(30) + (32) =	80.1680		(33)

Heat capacity Cm = Sum(A x k) (28) ... (30) + (32) + (32a) ... (32e) = 34560.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.7565 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.5100	0.0230	0.4717
E3 Sill	11.8900	0.0200	0.2378
E4 Jamb	32.7900	0.0160	0.5246
E5 Ground floor (normal)	39.3500	0.0620	2.4397
E6 Intermediate floor within a dwelling	41.2600	0.0010	0.0413
E10 Baves (insulation at ceiling level)	15.8900	0.0670	1.0646
E12 Gable (insulation at ceiling level)	19.8400	0.0550	1.0912
E13 Gable (insulation at rafter level)	6.2000	0.0400	0.2480
E16 Corner (normal)	25.7100	0.0400	1.0284
E17 Corner (inverted - internal area greater than external area)	5.1400	-0.0700	-0.3598
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7876 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 86.9555 (37)

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

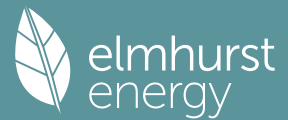
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.8287	49.8856	49.1499	46.9425	46.9425	44.7352	44.7352	43.9994	44.7352	48.4141	47.6783	49.8856
Heat transfer coeff	139.7843	136.8412	136.1054	133.8980	133.8980	131.6907	131.6907	130.9549	131.6907	135.3696	134.6338	136.8412
Average = Sum(39)m / 12 =												134.4499 (39)
HLP	0.7837	0.7672	0.7631	0.7507	0.7507	0.7383	0.7383	0.7342	0.7383	0.7589	0.7548	0.7672
HLP (average)												0.7538 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9737 (42)
Hot water usage for mixer showers	74.0785	72.9653	71.3431	68.2392	65.9486	63.3942	61.9423	63.5523	65.3171	68.0597	71.2302	73.7947 (42a)
Hot water usage for baths	31.9794	31.5045	30.8357	29.6025	28.6791	27.6552	27.1022	27.7663	28.4894	29.5850	30.8436	31.8713 (42b)
Hot water usage for other uses	45.0834	43.4440	41.8046	40.1652	38.5258	36.8864	36.8864	38.5258	40.1652	41.8046	43.4440	45.0834 (42c)
Average daily hot water use (litres/day)												138.9328 (43)
Daily hot water use	151.1413	147.9137	143.9833	138.0069	133.1535	127.9358	125.9309	129.8443	133.9717	139.4493	145.5178	150.7494 (44)
Energy conte	239.3709	210.6272	221.2970	188.9245	179.2503	157.3120	152.3025	160.7744	165.2005	189.2314	207.3168	236.0371 (45)
Energy content (annual)										Total = Sum(45)m =		2307.6445
Distribution loss (46)m = 0.15 x (45)m	35.9056	31.5941	33.1945	28.3387	26.8875	23.5968	22.8454	24.1162	24.7801	28.3847	31.0975	35.4056 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.3500 (55)
Total storage loss	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (56)
If cylinder contains dedicated solar storage	41.8500	37.8000	41.8500	40.5000	41.8500	40.5000	41.8500	41.8500	40.5000	41.8500	40.5000	41.8500 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (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	304.4833	269.4384	285.0136	245.1829	231.5683	207.7173	204.3879	213.7904	222.8096	252.9481	270.3288	301.1495 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												780.4913 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												780.4913
Solar input	-4.9411	-23.1143	-69.9277	-96.3321	-118.3860	-119.1083	-115.3956	-104.3912	-75.5895	-42.9288	-10.3768	-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	299.5422	246.3241	215.0860	148.8508	113.1823	88.6091	88.9923	109.3992	147.2201	210.0193	259.9520	301.1495 (64)
												Total per year (kWh/year) = Sum(64)m = 2228.3269 (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	131.6808	117.0825	124.5546	107.8241	101.4552	92.6305	92.3089	95.8703	101.0165	113.8928	119.3424	130.5723 (65)

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

Full SAP Calculation Printout



Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203	178.4203
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0112	40.8667	33.2350	25.1611	18.8082	15.8787	17.1575	22.3019	29.9336	38.0076	44.3604	47.2900
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	522.3770	527.7977	514.1378	485.0577	448.3492	413.8484	390.7997	385.3791	399.0389	428.1191	464.8276	499.3284
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157	55.8157
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
Losses e.g. evaporation (negative values) (Table 5)	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468	-118.9468
Water heating gains (Table 5)	176.9903	174.2299	167.4121	149.7557	136.3645	128.6534	124.0711	128.8579	140.3006	153.0817	165.7534	175.5004
Total internal gains	860.6676	858.1834	830.0740	775.2636	718.8110	673.6696	647.3174	651.8280	684.5622	734.4974	790.2305	837.4078

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					14.4500	13.8645		0.6300	0.7000	0.7700		61.2273 (74)	
East					0.5000	25.9136		0.6300	0.7000	0.7700		3.9598 (76)	
South					18.2000	58.2505		0.6300	0.7000	0.7700		323.9985 (78)	
Solar gains	389.1856	559.5152	754.6422	959.7015	1045.6957	1135.6406	1063.5287	978.3604	867.0966	650.8450	460.0748	319.3426 (83)	
Total gains	1249.8532	1417.6986	1584.7163	1734.9651	1764.5067	1809.3102	1710.8461	1630.1883	1551.6588	1385.3425	1250.3053	1156.7504 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000
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	68.6780	70.1550	70.5343	71.6971	71.6971	72.8988	72.8988	73.3084	72.8988	70.9177	71.3052	70.1550
alpha	5.5785	5.6770	5.7023	5.7798	5.7798	5.8599	5.8599	5.8872	5.8599	5.7278	5.7537	5.6770
util living area	0.9804	0.9619	0.9106	0.7929	0.6195	0.4063	0.2847	0.2971	0.5044	0.8025	0.9479	0.9852
Living	20.3744	20.5080	20.6927	20.8556	20.9272	20.9457	20.9469	20.9471	20.9425	20.8656	20.6389	20.3574
Non living	19.6996	19.8418	20.0199	20.1744	20.2308	20.2536	20.2541	20.2580	20.2520	20.1786	19.9791	19.6957
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.6800	20.5080	20.6927	20.8556	20.9272	20.9457	20.9469	20.9471	20.9425	20.8656	20.6389	20.4473
Th 2	20.2675	20.2819	20.2855	20.2963	20.2963	20.3071	20.3071	20.3107	20.3071	20.2891	20.2927	20.2819
util rest of house	0.9758	0.9537	0.8930	0.7601	0.5729	0.3566	0.2314	0.2418	0.4481	0.7618	0.9350	0.9816
MIT 2	19.9770	19.8418	20.0199	20.1744	20.2308	20.2536	20.2541	20.2580	20.2520	20.1786	19.9791	19.7777
Living area fraction									fLA = Living area / (4) =			0.1259
MIT	20.0655	19.9257	20.1046	20.2602	20.3185	20.3407	20.3414	20.3448	20.3389	20.2651	20.0622	19.8620
Temperature adjustment												0.0000
adjusted MIT	20.0655	19.9257	20.1046	20.2602	20.3185	20.3407	20.3414	20.3448	20.3389	20.2651	20.0622	19.8620

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9743	0.9489	0.8881	0.7584	0.5744	0.3590	0.2341	0.2445	0.4507	0.7603	0.9300	0.9791
Useful gains	1217.7493	1345.3118	1407.3598	1315.7262	1013.5091	649.6045	400.4568	398.6501	699.3538	1053.2686	1162.8392	1132.5670
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000
Heat loss rate W	2050.0044	1946.6623	1742.7740	1427.3756	1033.4878	650.6453	400.5187	398.7257	703.0884	1145.9149	1570.1218	1965.3143
Space heating kWh	619.1979	404.1076	249.5482	80.3876	14.8642	0.0000	0.0000	0.0000	0.0000	68.9288	293.2435	619.5640
Space heating requirement - total per year (kWh/year)												2349.8418
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	619.1979	404.1076	249.5482	80.3876	14.8642	0.0000	0.0000	0.0000	0.0000	68.9288	293.2435	619.5640
Space heating requirement after solar contribution - total per year (kWh/year)												2349.8418
Space heating per m2										(98c) / (4) =		13.1740

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000
Fraction of space heat from main system(s)												1.0000
Efficiency of main space heating system 1 (in %)												391.5114
Efficiency of main space heating system 2 (in %)												0.0000
Efficiency of secondary/supplementary heating system, %												0.0000
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	619.1979	404.1076	249.5482	80.3876	14.8642	0.0000	0.0000	0.0000	0.0000	68.9288	293.2435	619.5640
Space heating efficiency (main heating system 1)	391.5114	391.5114	391.5114	391.5114	391.5114	0.0000	0.0000	0.0000	0.0000	391.5114	391.5114	391.5114
Space heating fuel (main heating system)	158.1558	103.2173	63.7397	20.5326	3.7966	0.0000	0.0000	0.0000	0.0000	17.6058	74.9004	158.2493
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
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
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

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	600.1976	1.5858	951.8010 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1272.9992	1.5395	1959.8029 (278)
Space and water heating			2911.6039 (279)
Pumps, fans and electric keep-hot	658.8463	1.5128	996.7027 (281)
Energy for lighting	325.0287	1.5338	498.5398 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2212.5211	1.5065	-3333.2533
PV Unit electricity exported	0.0000	0.0000	0.0000

Total
Total Primary energy kWh/year

-3333.2533 (283)
1073.5931 (286)

Predicted Energy Assessment

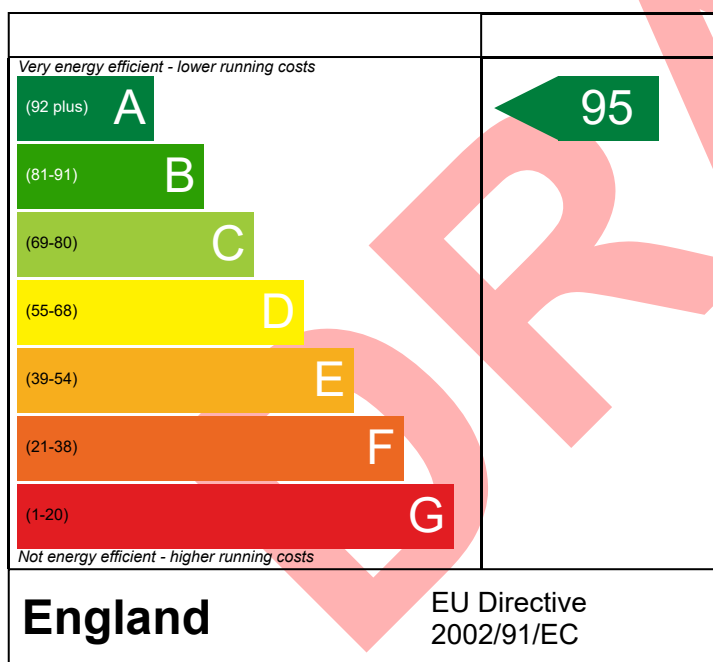


Dwelling type: House, Detached
Date of assessment: 25/06/2024
Produced by: James Gradwell
Total floor area: 178.37 m²
DRRN:

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

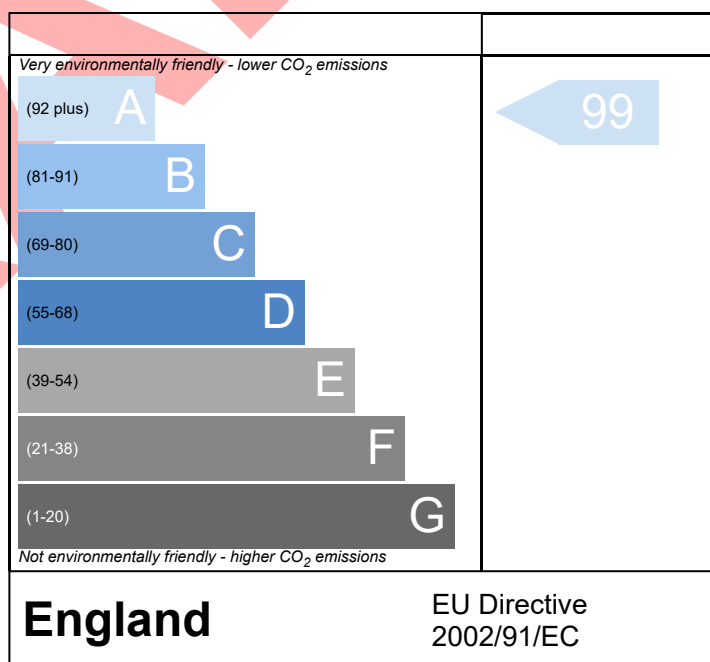
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data



Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Paul Giesberg	
Property				

SAP Rating	95 A	DER	1.19	TER	8.33
Environmental	99 A	% DER < TER			85.71
CO ₂ Emissions (t/year)	0.15	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	72.86	DPER	11.85	TPER	43.66

Assessor Details	Mr. James Gradwell	Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	39.35 m	88.62 m ²	2.50 m
		41.26 m	89.75 m ²	2.50 m

8.0 Living Area	22.46	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	Brickwork	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	106.24	86.29	0.00	None	19.95	Enter Gross Area
	Render	Cavity Wall	Cavity wall; dense plaster, lightweight aggregate block, filled cavity, any outside structure	0.18	140.00	98.37	85.17	0.00	None	13.20	Enter Gross Area

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	89.75	89.75	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
	Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.12	None	0.00	0.00	88.62

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
	Glazing	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.90

13.0 Openings	Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
	NORTH	Glazing	Brickwork	North	6.55	
	NORTH RENDER	Glazing	Render	North	7.90	
	SOUTH	Glazing	Brickwork	South	13.40	
	SOUTH RENDER	Glazing	Render	South	4.80	
	EAST	Glazing	Render	East	0.50	

Summary for Input Data

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	20.51	0.02	0.02 RCD	No
E3 Sill	Non Gov Approved Schemes	11.89	0.02	0.02 RCD	No
E4 Jamb	Non Gov Approved Schemes	32.79	0.02	0.02 RCD	No
E5 Ground floor (normal)	Non Gov Approved Schemes	39.35	0.06	0.06 RCD	No
E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	41.26	0.00	0.00 RCD	No
E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	15.89	0.07	0.07 RCD	No
E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	19.84	0.06	0.06 RCD	No
E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	6.20	0.04	0.04 RCD	No
E16 Corner (normal)	Non Gov Approved Schemes	25.71	0.04	0.04 RCD	No
E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	5.14	-0.07	-0.07 RCD	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀

 m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

Approved Installation

Mechanical Ventilation data Type

Type

MV Reference Number

Configuration

Manufacturer SFP

Duct Type

MVHR Efficiency

Wet Rooms

SFP from Installer Commissioning Certificate

MVHR System Location

Duct Installation Specification

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting	80.00	5	400	40

24.0 Main Heating 1

Percentage of Heat

 %

Database Ref. No.

Fuel Type

In Winter

In Summer

Model Name

Manufacturer

System Type

Controls SAP Code

Is MHS Pumped

Summary for Input Data

Heating Pump Age	2013 or later
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed
Flow Temperature	Enter value
Flow Temperature Value	35.00

25.0 Main Heating 2	None
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26.0 Heat Networks	None
--------------------	------

28.0 Water Heating	
Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers	Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
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28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	2.50	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store	None
--------------------	------

32.0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	No
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
7.00	South	45°	None Or Little		No	1.00		

34.0 Small-scale Hydro	None											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations
Lower cost measures
 None
Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
£4,000 - £6,000	£76	A 96	A 99

0
0

0
0

Thermal Bridging

Property Reference	Paul Giesberg		Issued on Date	25/06/2024
Assessment Reference	00001	Prop Type Ref	Detached House	
Property				

SAP Rating	95 A	DER	1.19	TER	8.33
Environmental	99 A	% DER < TER			85.71
CO ₂ Emissions (t/year)	0.15	DFEE	31.94	TFEE	38.04
Compliance Check	See BREL	% DFEE < TFEE			16.03
% DPER < TPER	72.86	DPER	11.85	TPER	43.66

Assessor Details	Mr. James Gradwell	Assessor ID	BJ35-0001
Client	Paul Giesberg, Paul Giesberg		

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Non Gov Approved Schemes	0.023	20.51	0.47	RCD
External wall	E3 Sill	Non Gov Approved Schemes	0.020	11.89	0.24	RCD
External wall	E4 Jamb	Non Gov Approved Schemes	0.016	32.79	0.52	RCD
External wall	E5 Ground floor (normal)	Non Gov Approved Schemes	0.062	39.35	2.44	RCD
External wall	E6 Intermediate floor within a dwelling	Non Gov Approved Schemes	0.001	41.26	0.04	RCD
External wall	E10 Eaves (insulation at ceiling level)	Non Gov Approved Schemes	0.067	15.89	1.06	RCD
External wall	E12 Gable (insulation at ceiling level)	Non Gov Approved Schemes	0.055	19.84	1.09	RCD
External wall	E13 Gable (insulation at rafter level)	Non Gov Approved Schemes	0.040	6.20	0.25	RCD
External wall	E16 Corner (normal)	Non Gov Approved Schemes	0.040	25.71	1.03	RCD
External wall	E17 Corner (inverted – internal area greater than external area)	Non Gov Approved Schemes	-0.070	5.14	-0.36	RCD

Total: 218.58 W/mK:
Y-Value: 0.02 W/m²K:

Overview Report

Dwelling Address	
Report Date	25/06/2024
Property Type	House, Detached
Floor Area [m ²]	178

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

Energy Rating

The current energy rating represents the overall energy efficiency of the dwelling. The potential energy rating is the overall energy rating of the dwelling after all of the recommend measures provided on the next page have been installed. A higher score represents a more energy efficient dwelling with lower fuel bills.

Most energy efficient - lower running costs

CURRENT

POTENTIAL

(92 plus)

A

95

96

(81-91)

B

(69-80)

C

(55-68)

D

(39-54)

E

(21-38)

F

(1-20)

G

Least energy efficient - higher running costs

Breakdown of property's energy performance

Each feature is assessed as one of the following:

Very Poor	Poor	Average	Good	Very Good
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Feature	Description	Energy Performance
Walls	Average thermal transmittance 0.18 W/m ² K	Very Good
Roof	Average thermal transmittance 0.11 W/m ² K	Very Good
Floor	Average thermal transmittance 0.12 W/m ² K	Very Good
Windows	High performance glazing	Very Good
Main heating	Air source heat pump, radiators and underfloor, electric	Very Good
Main heating controls	Programmer, room thermostat and TRVs	Good
Secondary heating	None	
Hot water	From main system	Average
Lighting	Good lighting efficiency	Good
Air tightness	Air permeability [AP50] = 4.0 m ³ /h.m ² (assumed)	Good

Primary Energy use

The primary energy use for this property per year is 8 kilowatt hour (kWh) per square metre

Estimated CO₂ emissions of the dwelling

The estimated CO rating provides an indication of the dwelling's impact on the environment in terms of carbon dioxide emissions; the higher the rating the less impact it has on the environment.

The estimated CO emissions for this dwellings is: **0.2** per year

Overview Report

With the recommended measures the potential CO emissions could be: **0.0** per year

Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

Recommended measure	Typical Yearly Saving	Potential Rating after measure installed	Cumulative savings (per year)	Cumulative Potential Rating
Solar water heating	£76	 1	£76	 A 96
Photovoltaic		 -96	£244	 G 0

Estimated energy use and potential savings

Estimated energy cost for this property over a year

£244

Over a year you could save

£76

The estimated cost and savings show how much the average household would spend in this property for heating, lighting and hot water. It is not based on how energy is used by the people living at the property.

Contacting the assessor and the accreditation scheme

Assessor contact details

Assessor name	Mr. James Gradwell
Assessor's accreditation number	
Email Address	

Accreditation scheme contact details

Accreditation scheme	
Telephone	
Email Address	

Assessment details

Related party disclosure	
Date of assessment	25/06/2024
Date of certificate	25/06/2024
Type of assessment	SAP, new dwelling