

Energy Assessment
For the proposed development at:
Land Rear of 1178-1184 Uxbridge Road, Hayes UB4 8JB

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

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Appendix 1 SAP calculations

1. Background

The development to proposed 4 new dwellings at rear of 1178-1184 Uxbridge Road, Hayes UB4 . the SAP calculations SAP 2012 have been completed to achieve compliance with L1A

The U - values and the services applied are required to be confirmed that they are suitable of the proposed new dwellings.

The dwelling has been design with fabric first to achieve the TER / DER, and the TFEE / DFEE, with the U - values ad applied services listed below show the dwelling complies with L1A building regulations, achieving a minimum of 35% reduction in Co2

2.1 National Policy

3.1.1 KYOTO PROTOCOL

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

3.1.2 BUILDING REGULATIONS – PART L 2013

This section of the building regulations deals with the conservation of energy in new domestic and commercial buildings; specifically the energy used for space heating/cooling, water heating, cooking, lighting and appliances. The methodology for the assessment of such has been adopted from the Building Research Establishment's Domestic Energy Model energy assessment method for the domestic portion of the building and Simplified Building Energy Model (SBEM) for the commercial units.

This method requires the calculation of a target emissions rate (TER), which assumes standard or typical building components and the calculation of the buildings actual emissions (DER for SAP). It is a requirement that the building's actual emissions will be lower than the target emission rate.

3. Building Regulations Compliance

Services Applied to the calculations are as follows

Please note the details below have been applied for the dwelling to comply with L1A building regulations and a minimum of 35% reduction in Co2, certain assumptions have been made and require to be confirmed. Please note these suggestions need to be clarified that they are suitable for the build, as they have only been applied for Part L building regulations, and for the purpose of efficiency only. Please could you confirm the details or forward any amendments required.

- Accredited construction details applied to table K1 *(can be down loaded from the planning portal to be uploaded and signed off during the construction of the build, completed forms are required for the as built SAP calculations, the ACDs that have been applied can be found within the calculations)*
- 100 % Low energy lighting
- Air pressure test to achieve 5.00 or less per unit
- Intermittent extract fans
- Time and temperature zone controls,
- Emitters- Underfloor
- *Air to water heat pump – Samsung AEO50RXYDEG – split efficiencies winter 304.10 Summer 285.70*
- *Water cylinder – 170ltr 1.32 heat loss*
- Delayed start thermostat
- Boiler interlock

The U - Values below have been applied to the dwelling to achieve compliance with L1A

L1A compliance

Element	U – value (w/mk2)	Element	U – value (W/m2K)
Wall	0.20	Roof	0.14
Floor	0.14	Exposed floor	0.14
Door	1.40	Windows (g value 0.63)	1.00
Party wall(filled cavity)	0.00		

4. Calculations - Domestic - reduction in Co2 and renewables: Results

The table 1 below shows the CO² emission from the dwelling , and compliance

Table1

Plot	SAP rating	Environmental	TFEE kWh/m ² /yr	DFEE kWh/m ² /yr	% Reduction	TER kgCO ₂ /yr/m ²	DER kgCO ₂ /yr/m ²	% Reduction
1	86 B	87 B	71.59	65.79	8.11	34.49	18.70	45.79
2	86 B	88 B	62.48	57.00	8.77	31.7	17.99	43.36
3	86 B	88 B	62.39	56.95	8.72	31.73	17.98	43.34
4	86 B	88 B	66.50	69.37	10.71	31.96	16.55	48.21
BK			65.76	59.76	9.12	32.47	17.76	45.30

With reference to the heat pump this has been chosen for the efficiency only and needs to be clarified that its suitable for use, if an alternative is used please inform us and we will check the efficiencies as an alternative boiler could make the calculations fail L1A building regulations.

5. CONSIDERATION OF Renewable and low carbon technologies

Consideration of Heat and power:

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Tri-generation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions.

While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30-40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant. However, space and water heating for the development is provided by mains gas and so a CHP unit would only reduce emissions associated with lighting, fans, pumps and domestic appliances. As such, the reduction in CO₂ would not be that great.

Generally CHP and CCHP are most suited to community heating systems particularly where there is a constant demand for heat throughout the year and therefore they are not considered to be viable on developments of less than approximately 50 units.

However, some systems for individual dwellings have been developed such as the Baxi Ecogen micro CHP. However the technology is new and is still proving its long term reliability.

The installation may be complex and can only be carried out by British Gas & one other supplier and therefore is relatively expensive. For these reasons it is considered that micro CHP installations are not a practical option at the present time for a very small development such as this.

5.1 OVERVIEW OF RENEWABLE ENERGY

Energy from renewable sources has been defined in Article 2 of EU Directive 2010/13/EU '*on the energy performance of buildings*' and includes wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. For the purposes of this energy Assessment and the use of renewable energy on a domestic scale these can be summarised as follows:

- _ Bio-fuels — combustion of solid or liquid bio-fuels to produce heat or electricity.
- _ Decentralised energy.
- _ Heat pumps — extraction of heat from the earth, atmosphere or water bodies.
- _ Hydroelectricity — use of water cycle driven flows to generate electricity.
- _ Photovoltaic — direct generation of electricity from sunlight.
- _ Solar thermal — direct heating of water for space heating or domestic hot water.
- _ Wind turbines — use of solar driven air movement to generate electricity.

The technologies and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions, mainly carbon dioxide, and none of the technologies are wholly “zero carbon”. This is because, when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets and to power the wood processing machinery for the production of wood fuel pellets.

Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following sections contain a summary of each possibly applicable technology, and a comparison of the advantages and disadvantages of technologies relevant to this development.

5.2 DECENTRALISED ENERGY

In addition to addressing the well understood and widely accepted planning policy requirement to install systems that will deliver a proportion of the development’s energy needs from renewable sources, a further consideration is the availability of decentralised energy. If it is feasible, new developments should incorporate community energy generating schemes so that future developments can be connected or where there are existing networks, the feasibility of connecting the subject development should be investigated. However in this case the development is too small to feasibly construct a new community heating scheme and at present, there is no such network available locally.

5.3 BIO-FUELS

Key planning and design issues regarding the use of bio-fuels include the building space and organisation to accommodate and operate the plant. The equipment would plant space and access and maintenance. Facilities are required for fuel storage and must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. Finally, systems utilising bio fuels, particularly biomass, are rarely available at the small scale that would be appropriate for use in a building where the heat loads are so low.

For these reasons the use of bio-fuels is not considered suitable for this development.

5.4 HEAT PUMPS

Heat pumps collect low temperature heat from renewable sources and “concentrate” it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump can deliver 3 kWh of heat energy for every 1 kWh of input energy i.e. an efficiency of 300%. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy.

5.4.1 Ground source heat pumps

There are two types of ground source heat pump system - a closed loop and open loop system. The first circulates anti-freeze through plastic pipe horizontally or vertically, the second uses ground water. Generally they work best where there is a constant heating or cooling demand or the property is off mains gas. In this case the property has access to mains gas and would not have a constant energy demand. Due to the small scale of the site a vertical closed loop system could be considered. Typically boreholes are around 10-100m deep and it is estimated that 1-2 boreholes might be required. The viability of a heat pump is dependent on the site ground conditions and geology and this requires a geological desk study and trial boreholes to obtain the necessary information. An environmental impact assessment is generally not required for a closed loop system. There is no visual impact to consider as the system is hidden from view.

Due to the uncertainty regarding ground conditions and the small scale of the development a ground source heat pump system is not considered suitable for this development.

5.4.2 Air source heat pumps (including exhaust air heat pumps)

Assuming an average coefficient of performance of 2.5 for an air source heat pump system, to provide 32,000 kWh of space and water heating would require only 12,800 kWh of energy demand from the heat pump system – a reduction of 19,200 kWh. Although this equates to a 56% of the total energy demand, as the heat pump would offset gas (baseline and lean cases) and would use mains electricity for its own power requirements this would actually represent an increase in CO₂ emissions. In addition, if an air source heat pump were installed, consideration would need to be given to potential noise impact on the dwelling occupants and neighbours. Heat pumps have been chosen moving to the preferred source of energy being electricity.

5.5 HYDROELECTRICITY

There is no suitable source of water in the locality which could be utilised as an energy source.

5.6 PHOTOVOLTAIC

Photovoltaic (PV) systems use areas of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the actual demand from the dwellings is less than that being produced by the PV system. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to planning, the exported electricity is by convention treated as if it were used on site.

The output of photovoltaic systems is generally specified as kW peak, or kWp with each 1kWp of system expected to produce an average 850 kWh of electricity per year, although this may be reduced depending on location, orientation and over shading. The area required to produce an output of 1 kWp varies but for this exercise 6.7m² has been used. (The developer will be required to submit a quotation and technical evaluation to ensure that the calculated quantity of panels will produce the required on site generation per annum)

Because the availability of sunlight, to produce electricity, will generally not align with demand, it is normal for the system to be connected to the electricity grid and excess production exported. The introduction of the feed-in-tariff has improved the economics of solar PV systems.

The installation of renewable technology ensures compliance with the London Plan but also helps to achieve sufficient credits under the Code for Sustainable Homes assessment. There are no direct environmental consequences from the installation of PV panels but the installation can have a visual impact that may require consideration.

5.7 SOLAR THERMAL PANELS

Solar thermal panels harness solar energy to heat domestic hot water. They are usually used in conjunction with the main heating system as they can only provide a portion of the demand for hot water, depending on the time of year. Overall, it is estimated that a suitably sized system can provide up to 60% of the annual energy demand for providing hot water. In this development that equates to an energy consumption of 2,017 kWh/yr which would provide a reduction in CO₂ emissions of 400 kg/yr. This represents a reduction in CO₂ emissions of 17.7% but requires the installation of a water cylinder in each dwelling. This is not currently planned for as it is proposed to use a combi boiler due to the small size of the dwellings. It is for this reason that solar thermal is not considered entirely suitable for the development.

5.8 WIND TURBINES

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels.

Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent trees and buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. From the Energy Saving Trust's wind prediction tool, the predicted average wind speed at the development site is 2.4 m/s, significantly less than 5 m/s. In addition noise and vibration from roof mounted turbines can prove unacceptable and wind turbines are less likely to meet with the approval of local residents and planners.

For these reasons wind turbines are not considered suitable for this development

Appendix 1

SAP Calculations

Energy Calculations Ltd

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01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 1 , 1178 -1184, Uxbridge Road
HAYES, UB4 8JB

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 13/06/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
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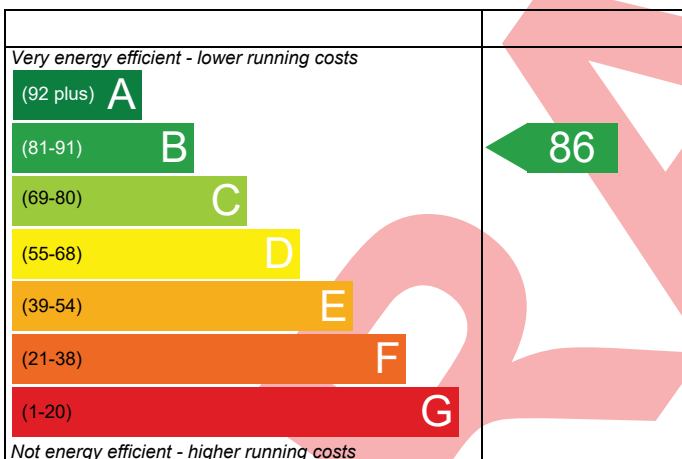
Plot 1 , 1178 -1184, Uxbridge Road,
HAYES,
UB4 8JB

Dwelling type: House, End-Terrace
Date of assessment: 13/06/2022
Produced by: Energy Calculations Limited
Total floor area: 59.22 m²

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 SAP2012 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

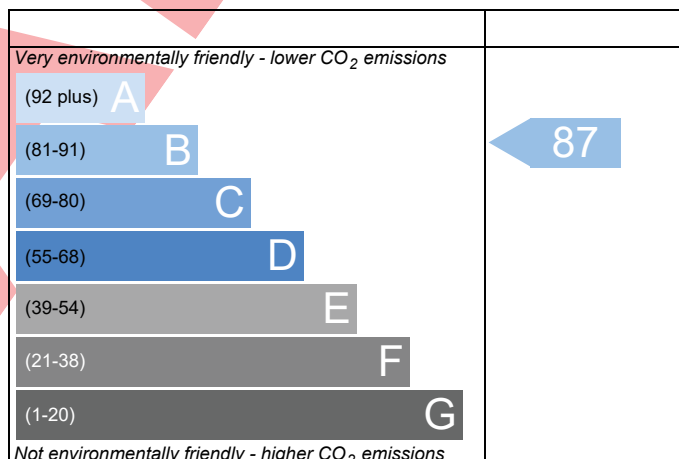


England

EU Directive
2002/91/EC

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



England

EU Directive
2002/91/EC

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.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

THERMAL BRIDGING

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Calculation Type: New Build (As Designed)

Property Reference	019662	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 1 , 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	18.70
Environmental	87 B	TER	34.49
CO ₂ Emissions (t/year)	0.92	% DER<TER	45.79
General Requirements Compliance	Pass	DFEE	65.79
		TFEE	71.59
		% DFEE<TFEE	8.11
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	11.10	3.33	
External wall	E3 Sill	Table K1 - Approved	0.040	7.50	0.30	
External wall	E4 Jamb	Table K1 - Approved	0.050	33.10	1.66	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	14.80	2.37	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	16.10	1.13	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	7.70	0.31	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	11.60	0.46	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	10.00	0.90	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.00	0.60	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	6.40	1.02	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	7.70	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Table K1 - Default	0.080	7.70	0.62	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	7.70	0.62	

Total: **13.31** W/mK:
Y-Value: **0.082** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Property Reference	019662			Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref			
Property	Plot 1 , 1178 -1184, Uxbridge Road, HAYES, UB4 8JB				
SAP Rating	86 B	DER	18.70	TER	34.49
Environmental	87 B	% DER<TER	45.79		
CO ₂ Emissions (t/year)	0.92	DFEE	65.79	TFEE	71.59
General Requirements Compliance	Pass	% DFEE<TFEE	8.11		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

End-Terrace House, total floor area 59 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 34.49 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.70 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)71.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)65.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.08 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Samsung Electronics AE050RXYDEG

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.32 kWh/day	
Permitted by DBSCG 2.03	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing North:	1.68 m ² , No overhang
Windows facing East:	9.45 m ² , No overhang
Windows facing West:	4.62 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Window U-value	1.00 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3080 (36)
Total fabric heat loss (33) + (36) = 58.0502 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	93.8735	93.6624	93.4556	92.4839	92.3021	91.4557	91.4557	91.2990	91.7817	92.3021	92.6698	93.0543 (39)
Average = Sum(39)m / 12 =												92.4830 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5852	1.5816	1.5781	1.5617	1.5586	1.5443	1.5443	1.5417	1.5498	1.5586	1.5648	1.5713 (40)
HLP (average)												1.5617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	346.2442	344.4491	333.5770	316.1190	298.5813	281.5053	270.2940	275.4659	284.3274	301.9698	322.2428	337.2667	(73)

6. Solar gains

[Jan]													
	Area	Solar flux		Specific data		Specific data		Access		Gains			
	m2	Table 6a		or Table 6b		or Table 6c		Table 6d		W			
		W/m2											
North	1.6800	10.6334		0.6300		0.7000		0.7700		5.4595		(74)	
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	89.9121	175.6407	289.8017	425.2792	524.6571	538.8772	512.2769	437.5226	337.7478	208.4519	112.0375	74.0011	(83)
Total gains	436.1563	520.0898	623.3788	741.3982	823.2384	820.3825	782.5708	712.9885	622.0753	510.4218	434.2803	411.2678	(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	48.5003	48.6096	48.7172	49.2291	49.3260	49.7825	49.7825	49.8679	49.6057	49.3260	49.1303	48.9273	
alpha	4.2334	4.2406	4.2478	4.2819	4.2884	4.3188	4.3188	4.3245	4.3070	4.2884	4.2754	4.2618	
util living area	0.9968	0.9928	0.9797	0.9347	0.8275	0.6564	0.4997	0.5629	0.8188	0.9677	0.9936	0.9975	(86)
Tweekday	18.0274	18.2387	18.6049	19.0677	19.3912	19.5358	19.5594	19.5586	19.4684	19.0248	18.4477	18.0018	
Tweekend	20.2102	20.3033	20.4665	20.6766	20.8416	20.9284	20.9519	20.9471	20.8770	20.6500	20.3914	20.1955	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7811	19.9222	20.1766	20.4950	20.7556	20.8900	20.9258	20.9184	20.8079	20.4599	20.0496	19.7584	(87)
Th 2	19.6242	19.6269	19.6294	19.6415	19.6438	19.6544	19.6544	19.6564	19.6503	19.6438	19.6392	19.6344	(88)
util rest of house	0.9955	0.9900	0.9715	0.9079	0.7612	0.5418	0.3543	0.4114	0.7229	0.9491	0.9906	0.9965	(89)
Tweekday	18.0274	18.2387	18.6049	19.0677	19.3912	19.5358	19.5594	19.5586	19.4684	19.0248	18.4477	18.0018	
Tweekend	18.0274	18.2387	18.6049	19.0677	19.3912	19.5358	19.5594	19.5586	19.4684	19.0248	18.4477	18.0018	
MIT 2	18.0274	18.2387	18.6049	19.0677	19.3912	19.5358	19.5594	19.5586	19.4684	19.0248	18.4477	18.0018	(90)
Living area fraction													
MIT	18.8234	19.0029	19.3183	19.7156	20.0105	20.1504	20.1796	20.1758	20.0764	19.6762	19.1748	18.7991	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8234	19.0029	19.3183	19.7156	20.0105	20.1504	20.1796	20.1758	20.0764	19.6762	19.1748	18.7991	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9883	0.9691	0.9096	0.7812	0.5866	0.4126	0.4725	0.7573	0.9497	0.9892	0.9957	(94)
Useful gains	433.7688	513.9881	604.1060	674.4029	643.1154	481.2234	322.9132	336.8810	471.0956	484.7288	429.6027	409.5029	(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	1363.3596	1320.9105	1197.9440	1000.2671	767.0744	507.6198	327.3734	344.7312	548.5257	837.7501	1118.9697	1358.5127 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	691.6155	542.2518	441.8155	234.6222	92.2254	0.0000	0.0000	0.0000	0.0000	262.6478	496.3443	706.0633 (98)
Space heating												3467.5858 (98)
Space heating per m2										(98) / (4) =		58.5543 (99)

8c. Space cooling requirement

Not applicable

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 %)												288.9309 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1200.1438 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	691.6155	542.2518	441.8155	234.6222	92.2254	0.0000	0.0000	0.0000	0.0000	262.6478	496.3443	706.0633 (98)
Space heating efficiency (main heating system 1)	288.9309	288.9309	288.9309	288.9309	288.9309	0.0000	0.0000	0.0000	0.0000	288.9309	288.9309	288.9309 (210)
Space heating fuel (main heating system)	239.3706	187.6753	152.9139	81.2036	31.9196	0.0000	0.0000	0.0000	0.0000	90.9034	171.7865	244.3710 (211)
Water heating 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 (215)
Water heating												
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												1200.1438 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Total delivered energy for all uses												2134.1419 (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	1200.1438	0.5190	622.8746 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			967.9106 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total CO2, kg/year			1107.6196 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7000 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.7000 ZC1
Total Floor Area	TFA	59.2200
Assumed number of occupants	N	1.9595
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.1085 ZC2
CO2 emissions from cooking, equation (L16)		2.8036 ZC3
Total CO2 emissions		38.6121 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		38.6121 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.8000	1.3258	14.3182		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	85.7800	14.8100	70.9700	0.1800	12.7746		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.1128		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4330 (36)
Total fabric heat loss						(33) + (36) =	50.5458 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	86.3690	86.1580	85.9511	84.9794	84.7976	83.9513	83.9513	83.7946	84.2773	84.7976	85.1654	85.5499 (39)
Average = Sum(39)m / 12 =												84.9785 (39)
HLP	1.4584	1.4549	1.4514	1.4350	1.4319	1.4176	1.4176	1.4150	1.4231	1.4319	1.4381	1.4446 (40)
HLP (average)												1.4350 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324 (46)	
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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)
Total heat required for water heating calculated for each month	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (62)
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 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (64)
Heat gains from water heating, kWh/month	82.4942	73.2576	78.2252	71.9108	71.7646	65.9841	65.1397	69.0397	68.1535	74.4798	76.5078	81.1124 (65)
Total per year (kWh/year) = Sum(64)m =												1839.9322 (64)

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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	15.5362	13.7991	11.2222	8.4959	6.3508	5.3616	5.7934	7.5305	10.1074	12.8337	14.9788	15.9680 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316 (68)
Pumps, fans	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799 (71)
Total internal gains	110.8793	109.0143	105.1413	99.8761	96.4578	91.6445	87.5534	92.7952	94.6577	100.1073	106.2609	109.0221 (72)
	352.7835	350.9556	340.0348	322.5253	304.9470	287.8524	276.6491	281.8539	290.7641	308.4581	328.7716	343.8142 (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					1.1500	10.6334	0.6300	0.7000			0.7700	3.7372 (74)
East					6.4800	19.6403	0.6300	0.7000			0.7700	38.8950 (76)
West					3.1700	19.6403	0.6300	0.7000			0.7700	19.0274 (80)
Solar gains	61.6595	120.4504	198.7388	291.6425	359.7883	369.5377	351.2973	300.0372	231.6181	142.9516	76.8327	50.7480 (83)
Total gains	414.4430	471.4059	538.7736	614.1678	664.7353	657.3900	627.9464	581.8910	522.3823	451.4096	405.6042	394.5622 (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	47.6154	47.7321	47.8470	48.3941	48.4978	48.9867	48.9867	49.0784	48.7973	48.4978	48.2884	48.0714
util living area	4.1744	4.1821	4.1898	4.2263	4.2332	4.2658	4.2658	4.2719	4.2532	4.2332	4.2192	4.2048
	0.9961	0.9927	0.9829	0.9511	0.8711	0.7208	0.5614	0.6190	0.8504	0.9704	0.9928	0.9968 (86)
MIT	19.4541	19.6190	19.9225	20.3304	20.6839	20.9041	20.9745	20.9617	20.7926	20.3305	19.8230	19.4288 (87)
Th 2	19.7188	19.7215	19.7242	19.7366	19.7390	19.7499	19.7499	19.7519	19.7457	19.7390	19.7342	19.7293 (88)
util rest of house	0.9947	0.9902	0.9765	0.9316	0.8190	0.6153	0.4150	0.4713	0.7700	0.9550	0.9898	0.9957 (89)
MIT 2	17.6967	17.9386	18.3798	18.9666	19.4356	19.6882	19.7413	19.7372	19.5829	18.9792	18.2456	17.6667 (90)
Living area fraction	0.9947	0.9902	0.9765	0.9316	0.8190	0.6153	0.4150	0.4713	0.7700	0.9550	0.9898	0.9957 (89)
MIT	18.4944	18.7013	19.0800	19.5857	20.0022	20.2401	20.3011	20.2930	20.1320	19.5926	18.9616	18.4665 (92)
Temperature adjustment	18.4944	18.7013	19.0800	19.5857	20.0022	20.2401	20.3011	20.2930	20.1320	19.5926	18.9616	18.4665 (93)
adjusted MIT	18.4944	18.7013	19.0800	19.5857	20.0022	20.2401	20.3011	20.2930	20.1320	19.5926	18.9616	18.4665 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9928	0.9873	0.9722	0.9288	0.8314	0.6598	0.4821	0.5388	0.7985	0.9526	0.9872	0.9941 (94)
Ext temp.	411.4665	465.4184	523.7702	570.4279	552.6504	433.7649	302.7076	313.5179	417.1029	430.0176	400.3948	392.2414 (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)
Month fracti	1225.9578	1189.0943	1081.2678	908.0608	704.0071	473.4927	310.7085	326.2154	508.3594	762.5486	1010.1950	1220.4970 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	605.9815	486.3102	414.7782	243.0957	112.6094	0.0000	0.0000	0.0000	0.0000	247.4031	439.0562	616.2222 (98)
												3165.4565 (98)
												53.4525 (99)

8c. Space cooling requirement

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3385.5149	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	605.9815	486.3102	414.7782	243.0957	112.6094	0.0000	0.0000	0.0000	0.0000	247.4031	439.0562	616.2222	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	648.1085	520.1179	443.6130	259.9954	120.4379	0.0000	0.0000	0.0000	0.0000	264.6022	469.5788	659.0612	(211)	
Water heating 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	(215)	
Water heating requirement	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274	(64)	
Efficiency of water heater (217)m	87.8029	87.6072	87.1425	86.0872	84.0996	79.8000	79.8000	79.8000	79.8000	86.0391	87.3124	87.8830	(216)	
Fuel for water heating, kWh/month	205.0994	181.3622	191.9201	174.7617	175.7602	166.1939	160.2621	174.9602	174.3702	181.2895	188.1442	200.1837	(219)	
Water heating fuel used												2174.3073	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3385.5149	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													274.3740	(232)
Total delivered energy for all uses													5909.1963	(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	3385.5149	0.2160	731.2712	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2174.3073	0.2160	469.6504	(264)
Space and water heating			1200.9216	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3740	0.5190	142.4001	(268)
Total CO2, kg/m2/year			1382.2467	(272)
Emissions per m2 for space and water heating			20.2790	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4046	(272b)
Emissions per m2 for pumps and fans			0.6573	(272c)
Target Carbon Dioxide Emission Rate (TER) = (20.2790 * 1.55) + 2.4046 + 0.6573, rounded to 2 d.p.			34.4900	(273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			9.0000	241.9200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16148.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							272.6866 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3080 (36)
Total fabric heat loss					(33) + (36) =		58.0502 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	93.8735	93.6624	93.4556	92.4839	92.3021	91.4557	91.4557	91.2990	91.7817	92.3021	92.6698	93.0543 (39)
Average = Sum(39)m / 12 =												92.4830 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5852	1.5816	1.5781	1.5617	1.5586	1.5443	1.5443	1.5417	1.5498	1.5586	1.5648	1.5713 (40)
HLP (average)												1.5617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

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Energy content (annual)	Total = Sum(45)m = 1270.3238 (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	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)
Heat gains from water heating, kWh/month	27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	27.1043 (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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305	(72)
Total internal gains	276.2281	275.1060	265.6317	250.0740	233.7699	218.4311	208.6962	211.9763	220.1657	235.8413	253.8935	267.9208	(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				1.6800	10.6334		0.6300	0.7000	0.7700		5.4595 (74)		
East				9.4500	19.6403		0.6300	0.7000	0.7700		56.7219 (76)		
West				4.6200	19.6403		0.6300	0.7000	0.7700		27.7307 (80)		

Solar gains	89.9121	175.6407	289.8017	425.2792	524.6571	538.8772	512.2769	437.5226	337.7478	208.4519	112.0375	74.0011 (83)	
Total gains	366.1402	450.7467	555.4335	675.3531	758.4270	757.3083	720.9731	649.4989	557.9136	444.2933	365.9310	341.9219 (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	47.7845	47.8921	47.9982	48.5025	48.5980	49.0477	49.0477	49.1319	48.8735	48.5980	48.4051	48.2051
alpha	4.1856	4.1928	4.1999	4.2335	4.2399	4.2698	4.2698	4.2755	4.2582	4.2399	4.2270	4.2137
util living area	0.9983	0.9956	0.9859	0.9497	0.8557	0.6942	0.5367	0.6072	0.8574	0.9791	0.9965	0.9987 (86)
MIT	19.3436	19.5397	19.8862	20.3394	20.7102	20.9174	20.9786	20.9645	20.7853	20.2737	19.7235	19.3128 (87)
Th 2	19.6242	19.6269	19.6294	19.6415	19.6438	19.6544	19.6544	19.6564	19.6503	19.6438	19.6392	19.6344 (88)
util rest of house	0.9976	0.9938	0.9801	0.9279	0.7952	0.5792	0.3833	0.4488	0.7713	0.9665	0.9948	0.9982 (89)
MIT 2	18.1454	18.3428	18.6878	19.1344	19.4638	19.6216	19.6502	19.6483	19.5407	19.0830	18.5362	18.1225 (90)
Living area fraction	18.6893	18.8861	19.2317	19.6813	20.0295	20.2098	20.2532	20.2457	20.1056	19.6234	19.0751	18.6628 (91)
MIT	18.6893	18.8861	19.2317	19.6813	20.0295	20.2098	20.2532	20.2457	20.1056	19.6234	19.0751	18.6628 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6893	18.8861	19.2317	19.6813	20.0295	20.2098	20.2532	20.2457	20.1056	19.6234	19.0751	18.6628 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	365.0082	447.3596	543.1226	627.2110	617.8362	477.0417	327.2665	339.0127	449.0610	429.2999	363.6700	341.1283	(94)
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	1350.7711	1309.9724	1189.8514	997.0980	768.8343	513.0460	334.1031	351.1131	551.2074	832.8817	1109.7325	1345.8244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	733.4076	579.6758	481.1662	266.3186	112.3426	0.0000	0.0000	0.0000	0.0000	300.2649	537.1650	747.4938	(98)
Space heating												3757.8346	(98)
Space heating per m2												63.4555	(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	859.6840	676.7725	693.8726	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8515	0.9096	0.8761	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	732.0287	615.6031	607.8766	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	958.4080	914.5016	832.0891	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	162.9931	222.3805	166.8141	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												552.1878 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.7483	55.5951	41.7035	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												138.0469 (107)
Space cooling per m2												2.3311 (108)
Energy for space heating												63.4555 (99)
Energy for space cooling												2.3311 (108)
Total												65.7866 (109)
Dwelling Fabric Energy Efficiency (DFEE)												65.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.8000	1.3258	14.3182		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	85.7800	14.8100	70.9700	0.1800	12.7746		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.1128		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4330 (36)
Total fabric heat loss						(33) + (36) =	50.5458 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	86.3690	86.1580	85.9511	84.9794	84.7976	83.9513	83.9513	83.7946	84.2773	84.7976	85.1654	85.5499 (39)
Average = Sum(39)m / 12 =												84.9785 (39)
HLP	1.4584	1.4549	1.4514	1.4350	1.4319	1.4176	1.4176	1.4150	1.4231	1.4319	1.4381	1.4446 (40)
HLP (average)												1.4350 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5362	13.7991	11.2222	8.4959	6.3508	5.3616	5.7934	7.5305	10.1074	12.8337	14.9788	15.9680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305	(72)
Total internal gains	276.5217	275.3668	265.8438	250.2345	233.8899	218.5324	208.8057	212.1186	220.3567	236.0839	254.1765	268.2226	(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	1.1500	10.6334	0.6300	0.7000	0.7700	3.7372 (74)
East	6.4800	19.6403	0.6300	0.7000	0.7700	38.8950 (76)
West	3.1700	19.6403	0.6300	0.7000	0.7700	19.0274 (80)

Solar gains	61.6595	120.4504	198.7388	291.6425	359.7883	369.5377	351.2973	300.0372	231.6181	142.9516	76.8327	50.7480	(83)
Total gains	338.1812	395.8172	464.5826	541.8770	593.6783	588.0701	560.1030	512.1558	451.9749	379.0354	331.0092	318.9706	(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	47.6154	47.7321	47.8470	48.3941	48.4978	48.9867	48.9867	49.0784	48.7973	48.4978	48.2884	48.0714	
alpha	4.1744	4.1821	4.1898	4.2263	4.2332	4.2658	4.2658	4.2719	4.2532	4.2332	4.2192	4.2048	
util living area	0.9982	0.9962	0.9899	0.9673	0.9040	0.7718	0.6167	0.6814	0.8961	0.9838	0.9967	0.9986	(86)
MIT	19.3411	19.5083	19.8178	20.2400	20.6199	20.8739	20.9637	20.9448	20.7333	20.2322	19.7133	19.3162	(87)
Th 2	19.7188	19.7215	19.7242	19.7366	19.7390	19.7499	19.7499	19.7519	19.7457	19.7390	19.7342	19.7293	(88)
util rest of house	0.9976	0.9948	0.9859	0.9533	0.8603	0.6698	0.4618	0.5285	0.8298	0.9747	0.9952	0.9981	(89)
MIT 2	18.2258	18.3945	18.7040	19.1271	19.4811	19.6917	19.7411	19.7365	19.5935	19.1272	18.6093	18.2089	(90)
Living area fraction	18.7320	18.9001	19.2095	19.6322	19.9980	20.2283	20.2961	20.2850	20.1109	19.6288	19.1104	18.7115	(91)
MIT	18.7320	18.9001	19.2095	19.6322	19.9980	20.2283	20.2961	20.2850	20.1109	19.6288	19.1104	18.7115	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7320	18.9001	19.2095	19.6322	19.9980	20.2283	20.2961	20.2850	20.1109	19.6288	19.1104	18.7115	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9969	0.9936	0.9838	0.9519	0.8708	0.7127	0.5332	0.5988	0.8528	0.9736	0.9942	0.9975	(94)
Useful gains	337.1164	393.2923	457.0675	515.7999	516.9659	419.1253	298.6272	306.6916	385.4294	369.0244	329.0865	318.1880	(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	1246.4803	1206.2188	1092.3989	912.0189	703.6539	472.5050	310.2885	325.5378	506.5787	765.6199	1022.8718	1241.4573	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	676.5668	546.2867	472.6866	285.2776	138.8959	0.0000	0.0000	0.0000	0.0000	295.0671	499.5254	686.9124	(98)
Space heating												3601.2183	(98)
Space heating per m2												60.8108	(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	789.1422	621.2396	636.8388	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7950	0.8677	0.8313	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	627.3321	539.0427	529.3955	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	760.7320	726.6174	671.7476	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	96.0479	139.5555	105.9100	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

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Space cooling											341.5134 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	24.0120	34.8889	26.4775	0.0000	0.0000	0.0000 (107)
Space cooling											85.3784 (107)
Space cooling per m2											1.4417 (108)
Energy for space heating											60.8108 (99)
Energy for space cooling											1.4417 (108)
Total											62.2526 (109)
Target Fabric Energy Efficiency (TFEE)											71.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3566	0.3400	0.3400	0.3151	0.3317	0.2985	0.2985	0.2737	0.2819	0.3068	0.2985	0.3317 (22b)
Effective ac	0.5636	0.5578	0.5578	0.5496	0.5550	0.5446	0.5446	0.5374	0.5397	0.5471	0.5446	0.5550 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3080 (36)
Total fabric heat loss (33) + (36) = 58.0502 (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	34.2518	33.9008	33.9008	33.4055	33.7315	33.0962	33.0962	32.6637	32.8037	33.2488	33.0962	33.7315 (38)
Heat transfer coeff	92.3021	91.9510	91.9510	91.4557	91.7817	91.1465	91.1465	90.7139	90.8539	91.2990	91.1465	91.7817 (39)
Average = Sum(39)m / 12 =												91.4608 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5586	1.5527	1.5527	1.5443	1.5498	1.5391	1.5391	1.5318	1.5342	1.5417	1.5391	1.5498 (40)
HLP (average)												1.5444 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
												Total per year (kWh/year) = Sum(64)m =	1804.3918 (64)
RHI water heating demand												1804	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(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				1.6800	12.3661		0.6300	0.7000		0.7700	6.3491 (74)	
East				9.4500	23.0580		0.6300	0.7000		0.7700	66.5924 (76)	
West				4.6200	23.0580		0.6300	0.7000		0.7700	32.5563 (80)	
Solar gains	105.4978	179.5120	295.2837	443.9128	529.2309	581.2982	549.4892	478.2282	368.9669	230.5445	127.0102	83.1980 (83)
Total gains	594.3317	664.8682	763.7735	886.2445	944.9502	972.9240	926.8234	862.4168	768.0115	655.9317	581.7450	559.9741 (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	49.3260	49.5144	49.5144	49.7825	49.6057	49.9514	49.9514	50.1896	50.1122	49.8679	49.9514	49.6057	
alpha	4.2884	4.3010	4.3010	4.3188	4.3070	4.3301	4.3301	4.3460	4.3408	4.3245	4.3301	4.3070	
util living area	0.9873	0.9786	0.9472	0.8532	0.6792	0.4245	0.2552	0.3038	0.6204	0.8973	0.9754	0.9897	(86)
Tweekday	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
Tweekend	20.3810	20.4572	20.6215	20.8055	20.9163	20.9554	20.9592	20.9590	20.9381	20.7923	20.5548	20.3642	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0446	20.1603	20.4159	20.6963	20.8708	20.9315	20.9371	20.9367	20.9034	20.6794	20.3048	20.0187	(87)
Th 2	19.6438	19.6482	19.6482	19.6544	19.6503	19.6583	19.6583	19.6637	19.6620	19.6564	19.6583	19.6503	(88)
util rest of house	0.9824	0.9706	0.9271	0.8018	0.5848	0.3040	0.1237	0.1644	0.4911	0.8466	0.9643	0.9858	(89)
Tweekday	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
Tweekend	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
MIT 2	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	(90)
Living area fraction												fLA = Living area / (4) =	0.4539 (91)
MIT	19.1602	19.3068	19.6179	19.9505	20.1292	20.1852	20.1887	20.1917	20.1672	19.9374	19.4962	19.1309	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1602	19.3068	19.6179	19.9505	20.1292	20.1852	20.1887	20.1917	20.1672	19.9374	19.4962	19.1309	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9802	0.9680	0.9266	0.8145	0.6203	0.3520	0.1758	0.2198	0.5425	0.8590	0.9626	0.9837	(94)
Useful gains	582.5416	643.5827	707.6936	721.8352	586.1819	342.4932	162.9619	189.5374	416.6329	563.4685	559.9589	550.8742	(95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)
Heat loss rate W	1288.5575	1251.1552	1105.0578	891.7350	626.7936	345.0035	163.0344	189.7429	433.1225	742.9335	1038.7234	1278.5999 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	525.2758	408.2887	295.6389	122.3278	30.2151	0.0000	0.0000	0.0000	0.0000	133.5220	344.7105	541.4279 (98)
Space heating												2401.4067 (98)
RHI space heating demand												2401 (98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3080 (36)
Total fabric heat loss						(33) + (36) =	58.0502 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	93.8735	93.6624	93.4556	92.4839	92.3021	91.4557	91.4557	91.2990	91.7817	92.3021	92.6698	93.0543 (39)
Average = Sum(39)m / 12 =												92.4830 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5852	1.5816	1.5781	1.5617	1.5586	1.5443	1.5443	1.5417	1.5498	1.5586	1.5648	1.5713 (40)
HLP (average)												1.5617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1270.3238 (45)										
Distribution loss (46)m = 0.15 x (45)m											
19.7558 17.2786 17.8299 15.5446 14.9154 12.8708 11.9267 13.6861 13.8495 16.1403 17.6184 19.1324 (46)											
Water storage loss:											
Store volume	170.0000 (47)										
a) If manufacturer declared loss factor is known (kWh/day):	1.3200 (48)										
Temperature factor from Table 2b	0.5400 (49)										
Enter (49) or (54) in (55)	0.7128 (55)										
Total storage loss											
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)											
If cylinder contains dedicated solar storage											
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (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)										
Total heat required for water heating calculated for each month											
177.0646 156.1600 164.2254 147.5264 144.7950 129.7016 124.8707 136.5998 136.2263 152.9612 161.3520 172.9088 (62)											
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 (63)										
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
177.0646 156.1600 164.2254 147.5264 144.7950 129.7016 124.8707 136.5998 136.2263 152.9612 161.3520 172.9088 (64)											
Heat gains from water heating, kWh/month											
80.0794 71.0765 75.8104 69.5739 69.3498 63.6472 62.7249 66.6249 65.8166 72.0650 74.1709 78.6976 (65)											
Total per year (kWh/year) = Sum(64)m =	1804.3918 (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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
38.1065 33.8458 27.5253 20.8384 15.5770 13.1507 14.2098 18.4705 24.7910 31.4779 36.7393 39.1656 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
255.1874 257.8354 251.1624 236.9564 219.0239 202.1698 190.9103 188.2622 194.9352 209.1412 227.0738 243.9278 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 48.7165 (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)													
-78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 -78.3799 (71)													
Water heating gains (Table 5)													
107.6336 105.7686 101.8956 96.6304 93.2121 88.3988 84.3077 89.5495 91.4120 96.8616 103.0152 105.7764 (72)													
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762 (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				1.6800	10.6334	0.6300	0.7000	0.7700	5.4595 (74)			
East				9.4500	19.6403	0.6300	0.7000	0.7700	56.7219 (76)			
West				4.6200	19.6403	0.6300	0.7000	0.7700	27.7307 (80)			
Solar gains	89.9121	175.6407	289.8017	425.2792	524.6571	538.8772	512.2769	437.5226	337.7478	208.4519	112.0375	74.0011 (83)
Total gains	578.7460	660.9969	758.2915	867.6108	940.3764	930.5030	889.6111	821.7112	736.7925	633.8391	566.7722	550.7772 (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	48.5003	48.6096	48.7172	49.2291	49.3260	49.7825	49.7825	49.8679	49.6057	49.3260	49.1303	48.9273	
alpha	4.2334	4.2406	4.2478	4.2819	4.2884	4.3188	4.3188	4.3245	4.3070	4.2884	4.2754	4.2618	
util living area	0.9907	0.9828	0.9607	0.8978	0.7722	0.5946	0.4442	0.4970	0.7456	0.9355	0.9830	0.9924 (86)	
Tweekday	18.2326	18.4343	18.7727	19.1790	19.4372	19.5451	19.5606	19.5611	19.5020	19.1575	18.6320	18.2046	
Tweekend	20.3018	20.3914	20.5444	20.7336	20.8714	20.9382	20.9546	20.9518	20.9036	20.7157	20.4746	20.2858	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9224	20.0585	20.2968	20.5840	20.8016	20.9050	20.9300	20.9256	20.8495	20.5613	20.1797	19.8977 (87)	
Th 2	19.6244	19.6269	19.6294	19.6415	19.6438	19.6544	19.6544	19.6564	19.6503	19.6438	19.6392	19.6344 (88)	
util rest of house	0.9872	0.9765	0.9462	0.8612	0.6990	0.4843	0.3126	0.3590	0.6407	0.9036	0.9757	0.9896 (89)	
Tweekday	18.2326	18.4343	18.7727	19.1790	19.4372	19.5451	19.5606	19.5611	19.5020	19.1575	18.6320	18.2046	
Tweekend	18.2326	18.4343	18.7727	19.1790	19.4372	19.5451	19.5606	19.5611	19.5020	19.1575	18.6320	18.2046	
MIT 2	18.2326	18.4343	18.7727	19.1790	19.4372	19.5451	19.5606	19.5611	19.5020	19.1575	18.6320	18.2046 (90)	
Living area fraction	fLA = Living area / (4) =												0.4539 (91)
MIT	18.9996	19.1715	19.4645	19.8167	20.0565	20.1623	20.1822	20.1805	20.1136	19.7947	19.3345	18.9731 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.9996	19.1715	19.4645	19.8167	20.0565	20.1623	20.1822	20.1805	20.1136	19.7947	19.3345	18.9731 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9738	0.9441	0.8666	0.7232	0.5277	0.3651	0.4143	0.6800	0.9079	0.9735	0.9877 (94)	
Useful gains	570.1661	643.7004	715.9123	751.8773	680.0409	491.0034	324.8284	340.4032	501.0480	575.4840	551.7602	544.0278 (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)	

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Heat loss rate W	1379.9034	1336.7055	1211.6037	1009.6224	771.3224	508.7086	327.6103	345.1525	551.9413	848.6905	1133.7671	1374.7007 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	602.4445	465.6994	368.7945	185.5765	67.9135	0.0000	0.0000	0.0000	0.0000	203.2656	419.0449	618.0206 (98)
Space heating												2930.7596 (98)
Space heating per m2										(98) / (4) =		49.4894 (99)

8c. Space cooling requirement

Not applicable

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 %)												288.9309 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1014.3463 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4445	465.6994	368.7945	185.5765	67.9135	0.0000	0.0000	0.0000	0.0000	203.2656	419.0449	618.0206 (98)
Space heating efficiency (main heating system 1)	288.9309	288.9309	288.9309	288.9309	288.9309	0.0000	0.0000	0.0000	0.0000	288.9309	288.9309	288.9309 (210)
Space heating fuel (main heating system)	208.5082	161.1802	127.6411	64.2287	23.5051	0.0000	0.0000	0.0000	0.0000	70.3509	145.0329	213.8991 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												1014.3463 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Total delivered energy for all uses												1948.3444 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1014.3463	13.1900	133.7923 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	13.1900	87.6883 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	13.1900	35.5060 (250)
Additional standing charges			0.0000 (251)
Total energy cost			256.9866 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0356 (257)
SAP value		85.5528
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1014.3463	0.5190	526.4457 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			871.4817 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			1011.1908 (272)
CO2 emissions per m2			17.0800 (273)
EI value			86.9987
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.8893 = 4.896$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.8893 = 0.1927$, stars = 5
Water heating energy efficiency	$13.19 / 2.7142 = 4.860$, stars = 4
Water heating environmental impact	$0.519 / 2.7142 = 0.1912$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3566	0.3400	0.3400	0.3151	0.3317	0.2985	0.2985	0.2737	0.2819	0.3068	0.2985	0.3317 (22b)
Effective ac	0.5636	0.5578	0.5578	0.5496	0.5550	0.5446	0.5446	0.5374	0.5397	0.5471	0.5446	0.5550 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3080 (36)
Total fabric heat loss					(33) + (36) =		58.0502 (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	34.2518	33.9008	33.9008	33.4055	33.7315	33.0962	33.0962	32.6637	32.8037	33.2488	33.0962	33.7315 (38)
Heat transfer coeff	92.3021	91.9510	91.9510	91.4557	91.7817	91.1465	91.1465	90.7139	90.8539	91.2990	91.1465	91.7817 (39)
Average = Sum(39)m / 12 =												91.4608 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5586	1.5527	1.5527	1.5443	1.5498	1.5391	1.5391	1.5318	1.5342	1.5417	1.5391	1.5498 (40)
HLP (average)												1.5444 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
Solar input	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(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	1.6800	12.3661	0.6300	0.7000	0.7700	6.3491 (74)
East	9.4500	23.0580	0.6300	0.7000	0.7700	66.5924 (76)
West	4.6200	23.0580	0.6300	0.7000	0.7700	32.5563 (80)

Solar gains	105.4978	179.5120	295.2837	443.9128	529.2309	581.2982	549.4892	478.2282	368.9669	230.5445	127.0102	83.1980	(83)
Total gains	594.3317	664.8682	763.7735	886.2445	944.9502	972.9240	926.8234	862.4168	768.0115	655.9317	581.7450	559.9741	(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	49.3260	49.5144	49.5144	49.7825	49.6057	49.9514	49.9514	50.1896	50.1122	49.8679	49.9514	49.6057	
alpha	4.2884	4.3010	4.3010	4.3188	4.3070	4.3301	4.3301	4.3460	4.3408	4.3245	4.3301	4.3070	
util living area	0.9873	0.9786	0.9472	0.8532	0.6792	0.4245	0.2552	0.3038	0.6204	0.8973	0.9754	0.9897	(86)
Tweekday	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
Tweekend	20.3810	20.4572	20.6215	20.8055	20.9163	20.9554	20.9592	20.9590	20.9381	20.7923	20.5548	20.3642	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0446	20.1603	20.4159	20.6963	20.8708	20.9315	20.9371	20.9367	20.9034	20.6794	20.3048	20.0187	(87)
Th 2	19.6438	19.6482	19.6482	19.6544	19.6503	19.6583	19.6583	19.6637	19.6620	19.6564	19.6583	19.6503	(88)
util rest of house	0.9824	0.9706	0.9271	0.8018	0.5848	0.3040	0.1237	0.1644	0.4911	0.8466	0.9643	0.9858	(89)
Tweekday	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
Tweekend	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	
MIT 2	18.4251	18.5973	18.9546	19.3305	19.5128	19.5649	19.5667	19.5724	19.5554	19.3206	18.8241	18.3929	(90)
Living area fraction													
fLA = Living area / (4) =												0.4539	(91)
MIT	19.1602	19.3068	19.6179	19.9505	20.1292	20.1852	20.1887	20.1917	20.1672	19.9374	19.4962	19.1309	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1602	19.3068	19.6179	19.9505	20.1292	20.1852	20.1887	20.1917	20.1672	19.9374	19.4962	19.1309	(93)

8. Space heating requirement

Utilisation	0.9802	0.9680	0.9266	0.8145	0.6203	0.3520	0.1758	0.2198	0.5425	0.8590	0.9626	0.9837	(94)
Useful gains	582.5416	643.5827	707.6936	721.8352	586.1819	342.4932	162.9619	189.5374	416.6329	563.4685	559.9589	550.8742	(95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Heat loss rate W	1288.5575	1251.1552	1105.0578	891.7350	626.7936	345.0035	163.0344	189.7429	433.1225	742.9335	1038.7234	1278.5999 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	525.2758	408.2887	295.6389	122.3278	30.2151	0.0000	0.0000	0.0000	0.0000	133.5220	344.7105	541.4279 (98)
Space heating												2401.4067 (98)
Space heating per m2										(98) / (4) =		40.5506 (99)

8c. Space cooling requirement

Not applicable

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 %)												286.3361 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												838.6672 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	525.2758	408.2887	295.6389	122.3278	30.2151	0.0000	0.0000	0.0000	0.0000	133.5220	344.7105	541.4279 (98)
Space heating efficiency (main heating system 1)	286.3361	286.3361	286.3361	286.3361	286.3361	0.0000	0.0000	0.0000	0.0000	286.3361	286.3361	286.3361 (210)
Space heating fuel (main heating system)	183.4473	142.5907	103.2489	42.7218	10.5523	0.0000	0.0000	0.0000	0.0000	46.6312	120.3867	189.0883 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												838.6672 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												269.1890 (232)
Electricity for lighting (calculated in Appendix L)												1772.6654 (238)
Total delivered energy for all uses												

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	838.6672	19.4400	163.0369 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	19.4400	129.2389 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	19.4400	52.3303 (250)
Additional standing charges			0.0000 (251)
Total energy cost			344.6061 (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	838.6672	0.5190	435.2683 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			780.3042 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			920.0133 (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	838.6672	3.0700	2574.7084 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	664.8092	3.0700	2040.9641 (264)
Space and water heating			4615.6725 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Primary energy kWh/year			5442.0827 (272)
Primary energy kWh/m2/year			91.8960 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 87

(For testing purposes):			
A			Not considered
B			Not considered
C			Not considered
D			Not considered
E	Low energy lighting		Already installed
F			Not considered
G			Not considered
H			Not considered
I			Not considered
J			Not considered
K			Not considered
M			Not considered
N	Solar water heating		Recommended
O			Not considered
P			Not considered
R			Not considered
S			Not considered
T			Not considered
U	Solar photovoltaic panels		Recommended
A2			Not considered
A3			Not considered
T2			Not considered
W			Not considered
X			Not considered
Y			Not considered
J2			Not considered
Q2			Not considered
Z1			Not considered
Z2			Not considered
Z3			Not considered
Z4			Not considered
Z5			Not considered
V2	Wind turbine		Not applicable
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures:			
N	Solar water heating	SAP change + 2.0	Cost change -£ 52
U	Solar photovoltaic panels	+ 12.8	-£ 355
CO2 change			
-140 kg (15.2%)			
-949 kg (121.6%)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£52	2.36 kg/m²	B 88 B 89
Solar photovoltaic panels	£355	16.02 kg/m²	A 100 A 100
Total Savings	£408	18.38 kg/m²	

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£345	£292	£52
Space heating	£163	£163	-£0
Water heating	£129	£77	£53
Lighting	£52	£52	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£345	-£63	£407
Total cost of uses	£344	-£63	£408
Delivered energy	30 kWh/m²	-5 kWh/m²	35 kWh/m²
Carbon dioxide emissions	0.9 tonnes	-0.2 tonnes	1.1 tonnes
CO2 emissions per m²	16 kg/m²	-3 kg/m²	18 kg/m²
Primary energy	92 kWh/m²	-17 kWh/m²	109 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3317 (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	0.4229	0.4146	0.4063	0.3649	0.3566	0.3151	0.3151	0.3068	0.3317	0.3566	0.3732	0.3897 (22b)
Effective ac	0.5894	0.5860	0.5826	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5760 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3080 (36)
Total fabric heat loss (33) + (36) = 58.0502 (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	35.8233	35.6122	35.4053	34.4336	34.2518	33.4055	33.4055	33.2488	33.7315	34.2518	34.6196	35.0041 (38)
Heat transfer coeff	93.8735	93.6624	93.4556	92.4839	92.3021	91.4557	91.4557	91.2990	91.7817	92.3021	92.6698	93.0543 (39)
Average = Sum(39)m / 12 =												92.4830 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5852	1.5816	1.5781	1.5617	1.5586	1.5443	1.5443	1.5417	1.5498	1.5586	1.5648	1.5713 (40)
HLP (average)												1.5617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.4277	(H8)
Utilisation factor												0.5036	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												80.7380	(H14)
Volume ratio Veff/V												0.9289	(H15)
Solar storage volume factor												0.9853	(H16)
Solar input												-791.2980	(H17)
Solar input	-22.9461	-38.2904	-65.2129	-87.3981	-107.9730	-106.1547	-104.7518	-91.5222	-71.6802	-48.9492	-27.2173	-19.2019	(63)
												-791.2980	(63)
Output from w/h													
	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069	(64)
												947.6214	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(73)

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					1.6800	10.6334		0.6300	0.7000	0.7700		5.4595 (74)	
East					9.4500	19.6403		0.6300	0.7000	0.7700		56.7219 (76)	
West					4.6200	19.6403		0.6300	0.7000	0.7700		27.7307 (80)	

Solar gains	89.9121	175.6407	289.8017	425.2792	524.6571	538.8772	512.2769	437.5226	337.7478	208.4519	112.0375	74.0011 (83)	
Total gains	578.7460	660.9969	756.7907	860.1068	926.6191	916.4955	875.6036	808.7043	730.7893	632.3383	566.7722	550.7772 (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	48.5003	48.6096	48.7172	49.2291	49.3260	49.7825	49.7825	49.8679	49.6057	49.3260	49.1303	48.9273	
alpha	4.2334	4.2406	4.2478	4.2819	4.2884	4.3188	4.3188	4.3245	4.3070	4.2884	4.2754	4.2618	
util living area	0.9907	0.9828	0.9610	0.9002	0.7787	0.6020	0.4508	0.5042	0.7494	0.9360	0.9830	0.9924	(86)
Tweekday	18.2326	18.4343	18.7709	19.1731	19.4326	19.5441	19.5605	19.5609	19.5007	19.1561	18.6320	18.2046	
Tweekend	20.3018	20.3914	20.5436	20.7305	20.8684	20.9371	20.9543	20.9514	20.9024	20.7150	20.4746	20.2858	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9224	20.0585	20.2956	20.5792	20.7969	20.9034	20.9295	20.9249	20.8477	20.5602	20.1797	19.8977	(87)
Th 2	19.6242	19.6269	19.6294	19.6415	19.6438	19.6544	19.6544	19.6564	19.6503	19.6438	19.6392	19.6344	(88)
util rest of house													

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.9872	0.9765	0.9466	0.8641	0.7061	0.4910	0.3175	0.3645	0.6447	0.9043	0.9757	0.9896 (89)
Tweekday	18.2326	18.4343	18.7709	19.1731	19.4326	19.5441	19.5605	19.5609	19.5007	19.1561	18.6320	18.2046
Tweekend	18.2326	18.4343	18.7709	19.1731	19.4326	19.5441	19.5605	19.5609	19.5007	19.1561	18.6320	18.2046
MIT 2	18.2326	18.4343	18.7709	19.1731	19.4326	19.5441	19.5605	19.5609	19.5007	19.1561	18.6320	18.2046 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	18.9996	19.1715	19.4630	19.8113	20.0519	20.1611	20.1819	20.1800	20.1121	19.7934	19.3345	18.9731 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9996	19.1715	19.4630	19.8113	20.0519	20.1611	20.1819	20.1800	20.1121	19.7934	19.3345	18.9731 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9738	0.9444	0.8693	0.7298	0.5346	0.3708	0.4205	0.6839	0.9085	0.9735	0.9877 (94)	
Useful gains	570.1661	643.7004	714.7363	747.6859	676.2811	489.9927	324.6344	340.0827	499.7877	574.4805	551.7602	544.0278 (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													
Month fracti	1379.9034	1336.7055	1211.4599	1009.1188	770.8930	508.5961	327.5861	345.1138	551.7985	848.5699	1133.7671	1374.7007 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating requirement	602.4445	465.6994	369.5624	188.2317	70.3912	0.0000	0.0000	0.0000	0.0000	203.9225	419.0449	618.0206 (98)	
Space heating per m2												2937.3173 (98)	
												(98) / (4) =	49.6001 (99)

8c. Space cooling requirement

Not applicable

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 %)													288.9309 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1016.6159 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4445	465.6994	369.5624	188.2317	70.3912	0.0000	0.0000	0.0000	0.0000	203.9225	419.0449	618.0206 (98)	
Space heating efficiency (main heating system 1)	288.9309	288.9309	288.9309	288.9309	288.9309	0.0000	0.0000	0.0000	0.0000	288.9309	288.9309	288.9309 (210)	
Space heating fuel (main heating system)	208.5082	161.1802	127.9069	65.1477	24.3627	0.0000	0.0000	0.0000	0.0000	70.5783	145.0329	213.8991 (211)	
Water heating 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 (215)	
Water heating requirement	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069 (64)	
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)	
Fuel for water heating, kWh/month	56.7834	43.4278	35.9658	19.6653	8.8527	4.0308	2.6129	12.1515	21.7907	37.8079	49.4205	56.6317 (219)	
Water heating fuel used												349.1411 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1016.6159 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
pump for solar water heating												50.0000 (230g)	
Total electricity for the above, kWh/year												50.0000 (231)	
Electricity for lighting (calculated in Appendix L)												269.1890 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =													
Total delivered energy for all uses									-1727.2394			-1727.2394 (233)	
												-42.2933 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1016.6159	13.1900	134.0916 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	349.1411	13.1900	46.0517 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	269.1890	13.1900	35.5060 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			-5.5785 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	-0.0225 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 100.3136
SAP rating (Section 12) 100 (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	1016.6159	0.5190	527.6237 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	349.1411	0.5190	181.2043 (264)
Space and water heating			708.8279 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-21.9502 (272)
CO2 emissions per m2			-0.3700 (273)
EI value			100.2822
EI rating			100 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3317 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3566	0.3400	0.3400	0.3151	0.3317	0.2985	0.2985	0.2737	0.2819	0.3068	0.2985	0.3317 (22b)
Effective ac	0.5636	0.5578	0.5578	0.5496	0.5550	0.5446	0.5446	0.5374	0.5397	0.5471	0.5446	0.5550 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			15.7500	0.9615	15.1442		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	85.7800	19.7600	66.0200	0.2000	13.2040	60.0000	3961.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			162.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7422		(33)
Party Wall 1			55.4000	0.0000	0.0000	140.0000	7756.0000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16390.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 276.7717 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3080 (36)
Total fabric heat loss (33) + (36) = 58.0502 (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	34.2518	33.9008	33.9008	33.4055	33.7315	33.0962	33.0962	32.6637	32.8037	33.2488	33.0962	33.7315 (38)
Heat transfer coeff	92.3021	91.9510	91.9510	91.4557	91.7817	91.1465	91.1465	90.7139	90.8539	91.2990	91.1465	91.7817 (39)
Average = Sum(39)m / 12 =												91.4608 (39)
HLP	1.5586	1.5527	1.5527	1.5443	1.5498	1.5391	1.5391	1.5318	1.5342	1.5417	1.5391	1.5498 (40)
HLP (average)												1.5444 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Energy content (annual)	Total = Sum(45)m =											1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968 (56)
If cylinder contains dedicated solar storage												
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968 (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)
Total heat required for water heating calculated for each month												
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1142.6174 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1919.5973 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.5111 (H8)
Utilisation factor												0.4841 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												80.7380 (H14)
Volume ratio Veff/V												0.9289 (H15)
Solar storage volume factor												0.9853 (H16)
Solar input												-804.9938 (H17)
Solar input	-25.5083	-37.1066	-63.1454	-86.9824	-104.1182	-109.5914	-107.4819	-95.4929	-74.5104	-51.3676	-29.2373	-20.4515 (63)
	Solar input (sum of months) = Sum(63)m =											-804.9938 (63)
Output from w/h												
	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573 (64)
	Total per year (kWh/year) = Sum(64)m =											933.9256 (64)
Heat gains from water heating, kWh/month												
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976 (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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(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				1.6800	12.3661		0.6300		0.7000		0.7700		6.3491 (74)
East				9.4500	23.0580		0.6300		0.7000		0.7700		66.5924 (76)
West				4.6200	23.0580		0.6300		0.7000		0.7700		32.5563 (80)
Solar gains	105.4978	179.5120	295.2837	443.9128	529.2309	581.2982	549.4892	478.2282	368.9669	230.5445	127.0102	83.1980	(83)
Total gains	594.3317	664.8682	762.2727	878.7405	931.1928	958.9165	912.8159	849.4099	762.0083	654.4309	581.7450	559.9741	(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	49.3260	49.5144	49.5144	49.7825	49.6057	49.9514	49.9514	50.1896	50.1122	49.8679	49.9514	49.6057
alpha	4.2884	4.3010	4.3010	4.3188	4.3070	4.3301	4.3301	4.3460	4.3408	4.3245	4.3301	4.3070
util living area	0.9873	0.9786	0.9475	0.8562	0.6864	0.4303	0.2591	0.3084	0.6242	0.8979	0.9754	0.9897 (86)
Tweekday	18.4251	18.5973	18.9530	19.3261	19.5107	19.5647	19.5667	19.5724	19.5549	19.3195	18.8241	18.3929
Tweekend	20.3810	20.4572	20.6208	20.8030	20.9145	20.9551	20.9592	20.9590	20.9376	20.7917	20.5548	20.3642
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.0446	20.1603	20.4147	20.6924	20.8680	20.9311	20.9371	20.9367	20.9026	20.6785	20.3048	20.0187 (87)
Th 2	19.6438	19.6482	19.6482	19.6544	19.6503	19.6583	19.6583	19.6637	19.6620	19.6564	19.6583	19.6503 (88)
util rest of house												

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	0.9824	0.9706	0.9275	0.8054	0.5920	0.3084	0.1256	0.1669	0.4946	0.8474	0.9643	0.9858 (89)
Tweekday	18.4251	18.5973	18.9530	19.3261	19.5107	19.5647	19.5667	19.5724	19.5549	19.3195	18.8241	18.3929
Tweekend	18.4251	18.5973	18.9530	19.3261	19.5107	19.5647	19.5667	19.5724	19.5549	19.3195	18.8241	18.3929
MIT 2	18.4251	18.5973	18.9530	19.3261	19.5107	19.5647	19.5667	19.5724	19.5549	19.3195	18.8241	18.3929 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	19.1602	19.3068	19.6165	19.9463	20.1268	20.1849	20.1887	20.1916	20.1666	19.9363	19.4962	19.1309 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1602	19.3068	19.6165	19.9463	20.1268	20.1849	20.1887	20.1916	20.1666	19.9363	19.4962	19.1309 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9802	0.9680	0.9270	0.8177	0.6274	0.3570	0.1785	0.2231	0.5461	0.8598	0.9626	0.9837 (94)	
Useful gains	582.5416	643.5827	706.6059	718.5711	584.1925	342.3321	162.9559	189.5214	416.1546	562.6663	559.9589	550.8742 (95)	
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)	
Heat loss rate W	1288.5575	1251.1552	1104.9266	891.3527	626.5718	344.9838	163.0330	189.7399	433.0683	742.8393	1038.7234	1278.5999 (97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)	
Space heating kWh	525.2758	408.2887	296.3506	124.4027	31.5301	0.0000	0.0000	0.0000	0.0000	134.0487	344.7105	541.4279 (98)	
Space heating												2406.0351 (98)	
Space heating per m2										(98) / (4) =		40.6288 (99)	

8c. Space cooling requirement

Not applicable

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 %)													286.3361 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													840.2836 (211)
Space heating requirement	525.2758	408.2887	296.3506	124.4027	31.5301	0.0000	0.0000	0.0000	0.0000	134.0487	344.7105	541.4279 (98)	
Space heating efficiency (main heating system 1)	286.3361	286.3361	286.3361	286.3361	286.3361	0.0000	0.0000	0.0000	0.0000	286.3361	286.3361	286.3361 (210)	
Space heating fuel (main heating system)	183.4473	142.5907	103.4975	43.4464	11.0116	0.0000	0.0000	0.0000	0.0000	46.8152	120.3867	189.0883 (211)	
Water heating 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 (215)	
Water heating requirement	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573 (64)	
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)	
Fuel for water heating, kWh/month	55.8393	43.8640	36.7276	19.8185	10.2730	2.7646	1.6071	10.6886	20.7479	36.9169	48.6763	56.1713 (219)	
Water heating fuel used												344.0950 (219)	
Annual totals kWh/year													
Space heating fuel - main system												840.2836 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
pump for solar water heating												50.0000 (230g)	
Total electricity for the above, kWh/year												50.0000 (231)	
Electricity for lighting (calculated in Appendix L)												269.1890 (232)	
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1143 * 0.80) =									-1828.1879			-1828.1879 (233)	
Total delivered energy for all uses												-324.6202 (238)	

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	840.2836	19.4400	163.3511 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	344.0950	19.4400	66.8921 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	50.0000	19.4400	9.7200 (249)	
Energy for lighting	269.1890	19.4400	52.3303 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1828.1879	19.4400	-355.3997 (252)	
Total energy cost			-63.1062 (255)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
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FULL SAP CALCULATION PRINTOUT

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Space heating - main system 1	840.2836	0.5190	436.1072 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	344.0950	0.5190	178.5853 (264)
Space and water heating			614.6925 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	0.5190	-948.8295 (269)
Total kg/year			-168.4779 (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	840.2836	3.0700	2579.6708 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	344.0950	3.0700	1056.3718 (264)
Space and water heating			3636.0426 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	3.0700	-5612.5368 (269)
Primary energy kWh/year			-996.5840 (272)
Primary energy kWh/m2/year			-16.8285 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	276.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	486.21 (P1)
Transmission heat loss coefficient	58.05 (37)
Summer heat loss coefficient	544.26 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.6800	81.1852	0.6300	0.7000	0.9000	48.7203
East	9.4500	117.5071	0.6300	0.7000	0.9000	396.6609
West	4.6200	117.5071	0.6300	0.7000	0.9000	193.9231

total: 639.3043

	Jun	Jul	Aug	
Solar gains	680	639	559	(P3)
Internal gains	392	377	384	
Total summer gains	1071	1017	943	(P5)

Summer gain/loss ratio	1.97	1.87	1.73	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 276.8)	0.06	0.06	0.06	
Threshold temperature	18.03	19.83	19.60	(P7)

Likelihood of high internal temperature Not significant Not significant Not significant

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019662	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 1 , 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	18.70
Environmental	87 B	TER	34.49
CO ₂ Emissions (t/year)	0.92	% DER<TER	45.79
General Requirements Compliance	Pass	DFEE	65.79
		TFEE	71.59
		% DFEE<TFEE	8.11
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	34.49	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.70	kgCO ₂ /m ²	Pass
	-15.79 (-45.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	71.59	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	65.79	kWh/m ² /yr	
	-5.8 (-8.1%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.08 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Samsung Electronics AE050RXYDEG	
Secondary heating system	None	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.32 kWh/day
Permitted by DBSCG 2.03

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

1.68 m², No overhang

Windows facing East

9.45 m², No overhang

Windows facing West

4.62 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Window U-value

1.00 W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019662	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 1 , 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	18.70
Environmental	87 B	% DER<TER	45.79
CO ₂ Emissions (t/year)	0.92	DFEE	65.79
General Requirements Compliance	Pass	% DFEE<TFEE	8.11
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
Client	7869-0001		

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	House, End-Terrace					
2.0 Number of Storeys	2					
3.0 Date Built	2022					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
		1st Storey:	14.80 m	26.88 m ²	2.40 m	
			16.10 m	32.34 m ²	3.70 m	
7.0 Living Area	26.88			m ²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	276.77			kJ/m ² K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.20	60.00	85.78
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	55.40
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame				9.00	22.08
Internal Wall 2	Plasterboard on timber frame				9.00	4.32
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
Slope	External Slope Roof	Plasterboard, insulated slope		0.14	9.00	44.66

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	26.88

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	26.88
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.14	20.00	5.46

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	26.88

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Main Wall	West							1.91	
Front Windows	Window	[1] Main Wall	West	None	0.00					4.62	
Rear Door	Solid Door	[1] Main Wall	East							2.10	
Rear Windows	Window	[1] Main Wall	East	None	0.00					9.45	
Side Windows	Window	[1] Main Wall	North	None	0.00					1.68	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	11.10	0.300	No
Table K1 - Approved	E3 Sill	7.50	0.040	No
Table K1 - Approved	E4 Jamb	33.10	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	14.80	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	16.10	0.070	No
Table K1 - Approved	E11 Eaves (insulation at rafter level)	7.70	0.040	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	11.60	0.040	No
Table K1 - Approved	E16 Corner (normal)	10.00	0.090	No
Table K1 - Approved	E18 Party wall between dwellings	10.00	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	6.40	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.70	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	7.70	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	7.70	0.080	No

Y-value	0.082	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

Cross ventilation possible

Yes

Night Ventilation

No

Air change rate

8.00

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings

8

Total number of L.E.L. fittings

8

Percentage of L.E.L. fittings

100.00

%

External

External lights fitted

Yes

Light and motion sensor

Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	104361	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

HWP From main heating 1

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Water Heating	Main Heating 1
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
SAP Code	901
Immersion Only Heating Hot Water	Yes
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	170.00
Loss	1.32
Pipes insulation	Fully insulated primary pipework
31.0 Thermal Store	None

L
kWh/day

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
Solar water heating	£4,000 - £6,000	£52	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£355	A 100	

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000632	Issued on Date	13/06/2022
Block Name	Uxbridge Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
019662-001	1	59.22	18.70	34.49	45.79 %
019663-001	1	59.22	17.99	31.76	43.36 %
019664-001	1	59.22	17.98	31.73	43.34 %
019665-001	1	68.04	16.55	31.96	48.21 %
Totals:	4	245.7	71.22	129.94	
Average DER = 17.76 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 32.47 kgCO ₂ /m ²		45.30 %			

Block Compliance Report - DFEE

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
019662-001	1	59.22	65.79	71.59	8.11 %
019663-001	1	59.22	57.00	62.48	8.77 %
019664-001	1	59.22	56.95	62.39	8.72 %
019665-001	1	68.04	59.37	66.50	10.71 %
Totals:	4	245.7	239.10	262.95	
Average DFEE = 59.76 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 65.76 kWh/m ² /yr		9.12 %			

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 2, 1178 -1184, Uxbridge Road
HAYES, UB4 8JB

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 13/06/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

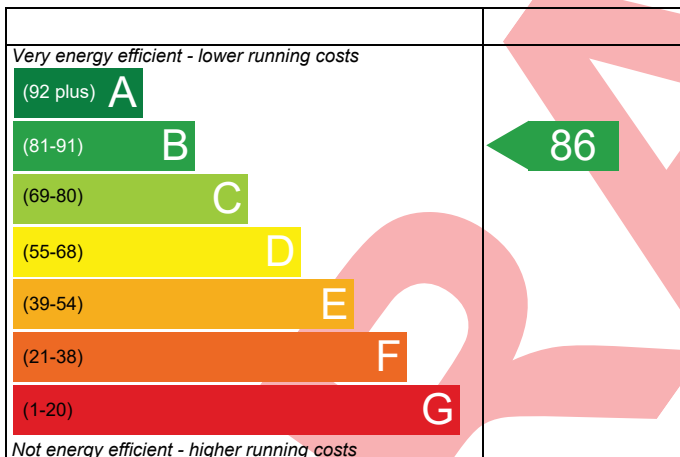
Plot 2, 1178 -1184, Uxbridge Road,
HAYES,
UB4 8JB

Dwelling type: House, Mid-Terrace
Date of assessment: 13/06/2022
Produced by: Energy Calculations Limited
Total floor area: 59.22 m²

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 SAP2012 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

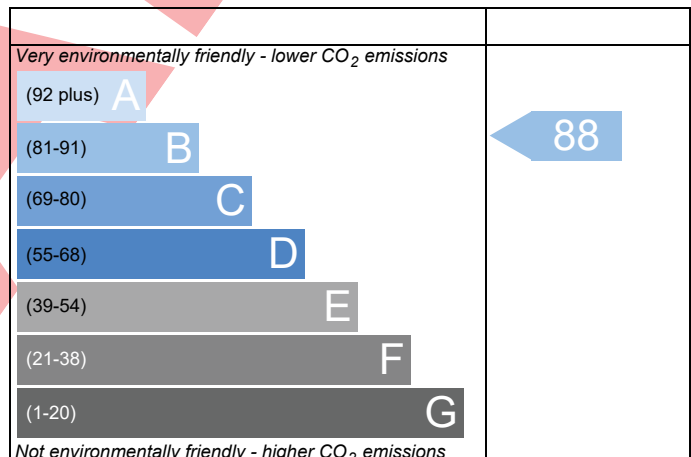


England

EU Directive
2002/91/EC

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



England

EU Directive
2002/91/EC

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.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

THERMAL BRIDGING

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019663	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 2, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.99
Environmental	88 B	TER	31.76
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.36
General Requirements Compliance	Pass	DFEE	57.00
		TFEE	62.48
		% DFEE<TFEE	8.77
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	9.90	2.97	
External wall	E3 Sill	Table K1 - Approved	0.040	6.30	0.25	
External wall	E4 Jamb	Table K1 - Approved	0.050	30.30	1.52	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	8.40	1.34	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	8.40	0.59	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	11.60	0.46	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	20.00	1.20	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	12.80	2.05	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	15.40	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Table K1 - Default	0.080	15.40	1.23	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	7.70	0.62	

Total: **12.23** W/mK:
Y-Value: **0.096** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Property Reference	019663			Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref			
Property	Plot 2, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB				
SAP Rating	86 B	DER	17.99	TER	31.76
Environmental	88 B	% DER<TER	43.36		
CO ₂ Emissions (t/year)	0.87	DFEE	57.00	TFEE	62.48
General Requirements Compliance	Pass	% DFEE<TFEE	8.77		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 59 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 31.76 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 57.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.09 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric

Samsung Electronics AE050RXYDEG

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.32 kWh/day	
Permitted by DBSCG 2.03	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing East:	9.45 m ² , No overhang
Windows facing West:	4.62 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Window U-value	1.00 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2290 (36)
Total fabric heat loss (33) + (36) = 48.6158 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5934	83.4152	83.2405	82.4200	82.2665	81.5519	81.5519	81.4195	81.8271	82.2665	82.5771	82.9018 (39)
Average = Sum(39)m / 12 =												82.4193 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4116	1.4086	1.4056	1.3918	1.3892	1.3771	1.3771	1.3749	1.3817	1.3892	1.3944	1.3999 (40)
HLP (average)												1.3917 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	346.2442	344.4491	333.5770	316.1190	298.5813	281.5053	270.2940	275.4659	284.3274	301.9698	322.2428	337.2667	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.4500	19.6403	0.6300	0.7000	0.7700		56.7219 (76)	
West					4.6200	19.6403	0.6300	0.7000	0.7700		27.7307 (80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497 (83)
Total gains	430.6968	509.6564	605.6499	712.9211	784.8771	779.3156	744.2297	682.5696	600.7594	498.0022	427.5453	406.7164 (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	54.8914	55.0087	55.1241	55.6729	55.7768	56.2655	56.2655	56.3570	56.0763	55.7768	55.5670	55.3494	
alpha	4.6594	4.6672	4.6749	4.7115	4.7185	4.7510	4.7510	4.7571	4.7384	4.7185	4.7045	4.6900	
util living area	0.9971	0.9932	0.9798	0.9312	0.8144	0.6332	0.4742	0.5340	0.7992	0.9659	0.9940	0.9978	(86)
Tweekday	18.3496	18.5481	18.8856	19.3002	19.5717	19.6806	19.6956	19.6958	19.6315	19.2534	18.7289	18.3232	
Tweekend	20.3100	20.3974	20.5479	20.7371	20.8776	20.9438	20.9591	20.9563	20.9057	20.7091	20.4735	20.2952	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9350	20.0678	20.3023	20.5894	20.8111	20.9136	20.9369	20.9326	20.8527	20.5511	20.1779	19.9123	(87)
Th 2	19.7545	19.7568	19.7590	19.7697	19.7716	19.7809	19.7809	19.7827	19.7774	19.7716	19.7676	19.7634	(88)
util rest of house	0.9960	0.9906	0.9718	0.9045	0.7499	0.5282	0.3470	0.4003	0.7061	0.9472	0.9912	0.9969	(89)
Tweekday	18.3496	18.5481	18.8856	19.3002	19.5717	19.6806	19.6956	19.6958	19.6315	19.2534	18.7289	18.3232	
Tweekend	18.3496	18.5481	18.8856	19.3002	19.5717	19.6806	19.6956	19.6958	19.6315	19.2534	18.7289	18.3232	
MIT 2	18.3496	18.5481	18.8856	19.3002	19.5717	19.6806	19.6956	19.6958	19.6315	19.2534	18.7289	18.3232	(90)
Living area fraction													
MIT	19.0692	19.2379	19.5286	19.8854	20.1342	20.2403	20.2590	20.2572	20.1858	19.8424	19.3866	19.0445	(91)
Temperature adjustment												0.0000	
adjusted MIT	19.0692	19.2379	19.5286	19.8854	20.1342	20.2403	20.2590	20.2572	20.1858	19.8424	19.3866	19.0445	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9892	0.9699	0.9074	0.7707	0.5695	0.3978	0.4538	0.7405	0.9486	0.9900	0.9963	(94)
Useful gains	428.6174	504.1538	587.4277	646.9183	604.9322	443.7993	296.0613	309.7785	444.8681	472.3935	423.2708	405.2003	(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													

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	1234.6121	1195.9964	1084.5101	905.4157	693.8556	459.9743	298.3990	314.0487	497.9844	760.3442	1014.5917	1230.6324 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	599.6601	464.9182	369.8293	186.1182	66.1591	0.0000	0.0000	0.0000	0.0000	214.2353	425.7510	614.1215 (98)
Space heating requirement												2940.7925 (98)
Space heating per m2											(98) / (4) =	49.6588 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.9020 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1118.5888 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	599.6601	464.9182	369.8293	186.1182	66.1591	0.0000	0.0000	0.0000	0.0000	214.2353	425.7510	614.1215 (98)
Space heating efficiency (main heating system 1)	262.9020	262.9020	262.9020	262.9020	262.9020	0.0000	0.0000	0.0000	0.0000	262.9020	262.9020	262.9020 (210)
Space heating fuel (main heating system)	228.0926	176.8409	140.6719	70.7937	25.1649	0.0000	0.0000	0.0000	0.0000	81.4886	161.9428	233.5933 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												1118.5888 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Total delivered energy for all uses												2052.5869 (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	1118.5888	0.5190	580.5476 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			925.5835 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total CO2, kg/year			1065.2926 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9900 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.9900 ZC1
Total Floor Area	TFA	59.2200
Assumed number of occupants	N	1.9595
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.1085 ZC2
CO2 emissions from cooking, equation (L16)		2.8036 ZC3
Total CO2 emissions		37.9021 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		37.9021 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	50.4000	14.8000	35.6000	0.1800	6.4080		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6690 (36)
Total fabric heat loss						(33) + (36) =	43.4019 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	78.3795	78.2013	78.0266	77.2061	77.0526	76.3380	76.3380	76.2056	76.6132	77.0526	77.3632	77.6878 (39)
Average = Sum(39)m / 12 =												77.2054 (39)
HLP	1.3235	1.3205	1.3176	1.3037	1.3011	1.2891	1.2891	1.2868	1.2937	1.3011	1.3064	1.3119 (40)
HLP (average)												1.3037 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324 (46)	
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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)
Total heat required for water heating calculated for each month	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (62)
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 (63)
Output from w/h	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (64)
Heat gains from water heating, kWh/month	82.4942	73.2576	78.2252	71.9108	71.7646	65.9841	65.1397	69.0397	68.1535	74.4798	76.5078	81.1124 (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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5384	13.8011	11.2238	8.4971	6.3517	5.3624	5.7942	7.5316	10.1089	12.8355	14.9809	15.9703	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	110.8793	109.0143	105.1413	99.8761	96.4578	91.6445	87.5534	92.7952	94.6577	100.1073	106.2609	109.0221	(72)
Total internal gains	352.7857	350.9575	340.0364	322.5265	304.9479	287.8531	276.6500	281.8550	290.7656	308.4599	328.7737	343.8164	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
East				7.2500	19.6403	0.6300	0.7000	0.7700			43.5168 (76)	
West				3.5400	19.6403	0.6300	0.7000	0.7700			21.2482 (80)	

Solar gains	64.7650	126.6941	208.6472	304.2995	372.9305	381.7607	363.4518	312.1997	242.6653	150.3333	80.7544	53.2596 (83)
Total gains	417.5507	477.6517	548.6836	626.8260	677.8784	669.6138	640.1017	594.0546	533.4309	458.7932	409.5281	397.0761 (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	52.4691	52.5886	52.7064	53.2665	53.3726	53.8723	53.8723	53.9658	53.6787	53.3726	53.1584	52.9362
alpha	4.4979	4.5059	4.5138	4.5511	4.5582	4.5915	4.5915	4.5977	4.5786	4.5582	4.5439	4.5291
util living area	0.9960	0.9921	0.9800	0.9399	0.8421	0.6736	0.5115	0.5675	0.8170	0.9648	0.9923	0.9968 (86)
MIT	19.6271	19.7923	20.0864	20.4677	20.7750	20.9420	20.9869	20.9792	20.8566	20.4464	19.9684	19.5992 (87)
Th 2	19.8224	19.8248	19.8271	19.8379	19.8400	19.8494	19.8494	19.8512	19.8458	19.8400	19.8358	19.8316 (88)
util rest of house	0.9946	0.9894	0.9728	0.9179	0.7868	0.5743	0.3845	0.4368	0.7342	0.9474	0.9891	0.9957 (89)
MIT 2	18.0182	18.2601	18.6864	19.2299	19.6279	19.8128	19.8450	19.8432	19.7359	19.2132	18.5255	17.9837 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	18.7485	18.9556	19.3218	19.7917	20.1486	20.3254	20.3633	20.3589	20.2446	19.7729	19.1804	18.7170 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7485	18.9556	19.3218	19.7917	20.1486	20.3254	20.3633	20.3589	20.2446	19.7729	19.1804	18.7170 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9929	0.9866	0.9689	0.9169	0.8031	0.6175	0.4425	0.4965	0.7660	0.9462	0.9866	0.9943	(94)
Ext temp.	414.5742	471.2688	531.5972	574.7245	544.4023	413.4869	283.2347	294.9498	408.5930	434.1026	404.0561	394.7933	(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)
Month fracti	1132.4643	1099.1643	1000.4451	840.9095	650.9837	437.0623	287.2804	301.6888	470.7540	706.7961	934.5799	1127.7917	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	534.1103	421.9458	348.8228	191.6533	79.2966	0.0000	0.0000	0.0000	0.0000	202.8840	381.9771	545.3508	(98)
Space heating per m2												2706.0406	(98)
												(98) / (4) =	45.6947 (99)

8c. Space cooling requirement

Not applicable

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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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2894.1611 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	534.1103	421.9458	348.8228	191.6533	79.2966	0.0000	0.0000	0.0000	0.0000	202.8840	381.9771	545.3508	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	571.2409	451.2789	373.0725	204.9767	84.8092	0.0000	0.0000	0.0000	0.0000	216.9883	408.5317	583.2629	(211)
Water heating 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	(215)
Water heating requirement	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274	(64)
Efficiency of water heater (217)m	87.5403	87.2980	86.7312	85.4606	83.2361	79.8000	79.8000	79.8000	79.8000	85.5161	86.9922	79.8000	(216)
Fuel for water heating, kWh/month	205.7145	182.0046	192.8301	176.0431	177.5835	166.1939	160.2621	174.9602	174.3702	182.3980	188.8367	200.7525	(219)
Water heating fuel used												2181.9494	(219)
Annual totals kWh/year													
Space heating fuel - main system												2894.1611	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.4132	(232)
Total delivered energy for all uses												5425.5237	(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	2894.1611	0.2160	625.1388	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2181.9494	0.2160	471.3011	(264)
Space and water heating			1096.4399	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.4132	0.5190	142.4205	(268)
Total CO2, kg/m2/year			1277.7853	(272)
Emissions per m2 for space and water heating			18.5147	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4049	(272b)
Emissions per m2 for pumps and fans			0.6573	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.5147 * 1.55) + 2.4049 + 0.6573, rounded to 2 d.p.			31.7600	(273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			9.0000	241.9200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16276.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							274.8548 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2290 (36)
Total fabric heat loss					(33) + (36) =		48.6158 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5934	83.4152	83.2405	82.4200	82.2665	81.5519	81.5519	81.4195	81.8271	82.2665	82.5771	82.9018 (39)
Average = Sum(39)m / 12 =												82.4193 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4116	1.4086	1.4056	1.3918	1.3892	1.3771	1.3771	1.3749	1.3817	1.3892	1.3944	1.3999 (40)
HLP (average)												1.3917 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

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Energy content (annual)	Total = Sum(45)m = 1270.3238 (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												
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)
Heat gains from water heating, kWh/month												
27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	27.1043	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305	(72)
Total internal gains	276.2281	275.1060	265.6317	250.0740	233.7699	218.4311	208.6962	211.9763	220.1657	235.8413	253.8935	267.9208	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East					9.4500	19.6403	0.6300	0.7000	0.7700		56.7219 (76)		
West					4.6200	19.6403	0.6300	0.7000	0.7700		27.7307 (80)		
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497 (83)	
Total gains	360.6807	440.3133	537.7046	646.8760	720.0657	716.2414	682.6319	619.0801	536.5977	431.8737	359.1960	337.3706 (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	54.0875	54.2031	54.3168	54.8576	54.9599	55.4415	55.4415	55.5316	55.2550	54.9599	54.7532	54.5388
alpha	4.6058	4.6135	4.6211	4.6572	4.6640	4.6961	4.6961	4.7021	4.6837	4.6640	4.6502	4.6359
util living area	0.9985	0.9961	0.9866	0.9488	0.8475	0.6752	0.5132	0.5811	0.8443	0.9791	0.9969	0.9989 (86)
MIT	19.5414	19.7259	20.0465	20.4582	20.7812	20.9457	20.9879	20.9791	20.8422	20.3885	19.8849	19.5106 (87)
Th 2	19.7545	19.7568	19.7590	19.7697	19.7716	19.7809	19.7809	19.7827	19.7774	19.7716	19.7676	19.7634 (88)
util rest of house	0.9980	0.9945	0.9812	0.9275	0.7885	0.5686	0.3775	0.4393	0.7600	0.9669	0.9954	0.9985 (89)
MIT 2	18.4422	18.6278	18.9470	19.3517	19.6356	19.7593	19.7785	19.7778	19.6970	19.2955	18.7954	18.4184 (90)
Living area fraction	fLA = Living area / (4) = 0.4539 (91)											
MIT	18.9411	19.1262	19.4461	19.8539	20.1556	20.2978	20.3275	20.3231	20.2168	19.7916	19.2899	18.9142 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9411	19.1262	19.4461	19.8539	20.1556	20.2978	20.3275	20.3231	20.2168	19.7916	19.2899	18.9142 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9935	0.9794	0.9293	0.8089	0.6161	0.4397	0.5046	0.7942	0.9672	0.9946	0.9981	(94)
Useful gains	359.7645	437.4453	526.6392	601.1103	582.4812	441.2850	300.1680	312.3674	426.1736	417.6926	357.2736	336.7395	(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													
	1223.9010	1186.6826	1077.6398	902.8225	695.6121	464.6659	303.9815	319.4142	500.5218	756.1601	1006.6079	1219.8291	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	642.9175	503.4875	409.9445	217.2328	84.1694	0.0000	0.0000	0.0000	0.0000	251.8199	467.5207	657.0186	(98)
Space heating												3234.1109	(98)
Space heating per m2												(98) / (4) =	54.6118 (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	766.5877	603.4839	618.7885	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8872	0.9371	0.9108	0.0000	0.0000	0.0000	0.0000 (101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	680.0991	565.5415	563.5870	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	910.4077	869.6873	796.5346	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	165.8222	226.2844	173.3131	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												565.4197 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.4556	56.5711	43.3283	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.3549 (107)
Space cooling per m2												2.3869 (108)
Energy for space heating												54.6118 (99)
Energy for space cooling												2.3869 (108)
Total												56.9987 (109)
Dwelling Fabric Energy Efficiency (DFEE)												57.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	50.4000	14.8000	35.6000	0.1800	6.4080		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6690 (36)
Total fabric heat loss						(33) + (36) =	43.4019 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	78.3795	78.2013	78.0266	77.2061	77.0526	76.3380	76.3380	76.2056	76.6132	77.0526	77.3632	77.6878 (39)
Average = Sum(39)m / 12 =												77.2054 (39)
HLP	1.3235	1.3205	1.3176	1.3037	1.3011	1.2891	1.2891	1.2868	1.2937	1.3011	1.3064	1.3119 (40)
HLP (average)												1.3037 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
Water 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 (46)
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)

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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)
Heat gains from water heating, kWh/month												
27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	27.1043	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5384	13.8011	11.2238	8.4971	6.3517	5.3624	5.7942	7.5316	10.1089	12.8355	14.9809	15.9703 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975 (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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799 (71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305 (72)
Total internal gains	276.5239	275.3688	265.8454	250.2357	233.8909	218.5332	208.8065	212.1197	220.3582	236.0857	254.1787	268.2249 (73)

[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	

East	7.2500	19.6403	0.6300	0.7000	0.7700	43.5168 (76)
West	3.5400	19.6403	0.6300	0.7000	0.7700	21.2482 (80)

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	52.4691	52.5886	52.7064	53.2665	53.3726	53.8723	53.8723	53.9658	53.6787	53.3726	53.1584	52.9362
alpha	4.4979	4.5059	4.5138	4.5511	4.5582	4.5915	4.5915	4.5977	4.5786	4.5582	4.5439	4.5291
util living area	0.9982	0.9960	0.9884	0.9599	0.8810	0.7278	0.5648	0.6297	0.8705	0.9810	0.9966	0.9987 (86)
MIT	19.5115	19.6794	19.9806	20.3800	20.7191	20.9201	20.9804	20.9685	20.8060	20.3483	19.8565	19.4840 (87)
Th 2	19.8224	19.8248	19.8271	19.8379	19.8400	19.8494	19.8494	19.8512	19.8458	19.8400	19.8358	19.8316 (88)
util rest of house	0.9976	0.9946	0.9840	0.9439	0.8334	0.6288	0.4281	0.4909	0.7994	0.9708	0.9951	0.9982 (89)
MIT 2	18.4755	18.6447	18.9454	19.3427	19.6524	19.8134	19.8447	19.8425	19.7375	19.3201	18.8305	18.4552 (90)
Living area fraction										fLA = Living area / (4) =	0.4539	0.4539 (91)
MIT	18.9458	19.1143	19.4153	19.8135	20.1366	20.3158	20.3602	20.3536	20.2225	19.7868	19.2962	18.9222 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9458	19.1143	19.4153	19.8135	20.1366	20.3158	20.3602	20.3536	20.2225	19.7868	19.2962	18.9222 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9934	0.9821	0.9435	0.8471	0.6717	0.4909	0.5546	0.8260	0.9702	0.9942	0.9977 (94)
Useful gains	340.2634	399.4272	465.9781	523.2222	514.0446	403.2218	280.8942	290.7777	382.4661	374.9060	332.9738	320.7467 (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	1147.9282	1111.5805	1007.7357	842.5913	650.0613	436.3294	287.0460	301.2837	469.0620	707.8666	943.5372	1143.7344 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	600.9027	478.5670	403.0676	229.9457	101.1964	0.0000	0.0000	0.0000	0.0000	247.7227	439.6056	612.3029 (98)
Space heating												3113.3106 (98)
Space heating per m2												52.5719 (99)
										(98) / (4) =		

[illegible]

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Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.5527	41.9300	32.4468	0.0000	0.0000	0.0000 (107)
Space cooling											103.9294 (107)
Space cooling per m2											1.7550 (108)
Energy for space heating											52.5719 (99)
Energy for space cooling											1.7550 (108)
Total											54.3269 (109)
Target Fabric Energy Efficiency (TFEE)											62.5 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2290 (36)
Total fabric heat loss (33) + (36) = 48.6158 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.2665	81.9701	81.9701	81.5519	81.8271	81.2907	81.2907	80.9255	81.0437	81.4195	81.2907	81.8271 (39)
Average = Sum(39)m / 12 =												81.5561 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3892	1.3842	1.3842	1.3771	1.3817	1.3727	1.3727	1.3665	1.3685	1.3749	1.3727	1.3817 (40)
HLP (average)												1.3772 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
												Total per year (kWh/year) = Sum(64)m =	1804.3918 (64)
RHI water heating demand												1804	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East		9.4500		23.0580		0.6300		0.7000		0.7700		66.5924	(76)
West		4.6200		23.0580		0.6300		0.7000		0.7700		32.5563	(80)
Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385	(83)
Total gains	587.9825	654.2025	745.4889	855.9478	905.4925	927.8001	884.9085	828.5051	744.3544	642.1268	574.1582	554.9147	(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	55.7768	55.9785	55.9785	56.2655	56.0763	56.4463	56.4463	56.7011	56.6184	56.3570	56.4463	56.0763	
alpha	4.7185	4.7319	4.7319	4.7510	4.7384	4.7631	4.7631	4.7801	4.7746	4.7571	4.7631	4.7384	
util living area	0.9869	0.9775	0.9424	0.8377	0.6525	0.3998	0.2386	0.2828	0.5859	0.8833	0.9735	0.9895	(86)
Tweekday	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
Tweekend	20.4754	20.5462	20.6946	20.8520	20.9364	20.9612	20.9631	20.9630	20.9512	20.8397	20.6306	20.4586	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1904	20.2981	20.5286	20.7689	20.9018	20.9404	20.9430	20.9430	20.9239	20.7526	20.4232	20.1644	(87)
Th 2	19.7716	19.7755	19.7755	19.7809	19.7774	19.7843	19.7843	19.7891	19.7876	19.7827	19.7843	19.7774	(88)
util rest of house	0.9820	0.9693	0.9217	0.7864	0.5652	0.2959	0.1272	0.1650	0.4703	0.8313	0.9619	0.9856	(89)
Tweekday	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
Tweekend	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
MIT 2	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	(90)
Living area fraction												fLA = Living area / (4) =	0.4539 (91)
MIT	19.3950	19.5309	19.8107	20.0928	20.2267	20.2630	20.2647	20.2674	20.2532	20.0797	19.6947	19.3653	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3950	19.5309	19.8107	20.0928	20.2267	20.2630	20.2647	20.2674	20.2532	20.0797	19.6947	19.3653	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9672	0.9224	0.8008	0.5987	0.3372	0.1713	0.2116	0.5163	0.8458	0.9609	0.9839	(94)
Useful gains	576.2908	632.7712	687.6068	685.4558	542.0817	312.8328	151.5554	175.3181	384.2738	543.0899	551.6993	545.9638	(95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1167.7715	1133.7237	1000.9116	806.7800	566.7900	314.0279	151.5836	175.4008	393.3245	674.1302	942.5414	1159.1023 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
Space heating	440.0616	336.6401	233.0988	87.3535	18.3830	0.0000	0.0000	0.0000	0.0000	97.4940	281.4063	456.1750 (98)
Space heating												1950.6124 (98)
RHI space heating demand												1951 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2290 (36)
Total fabric heat loss (33) + (36) = 48.6158 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5934	83.4152	83.2405	82.4200	82.2665	81.5519	81.5519	81.4195	81.8271	82.2665	82.5771	82.9018 (39)
Average = Sum(39)m / 12 =												82.4193 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4116	1.4086	1.4056	1.3918	1.3892	1.3771	1.3771	1.3749	1.3817	1.3892	1.3944	1.3999 (40)
HLP (average)												1.3917 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
Solar input	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(73)

6. Solar gains

[Jan]													
	Area	Solar flux		g		FF		Access		Gains			
	m2	Table 6a		or Table 6b		or Table 6c		factor		W			
		W/m2						Table 6d					
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497	(83)
Total gains	573.2865	650.5635	740.5626	839.1337	902.0151	889.4361	851.2699	791.2924	715.4766	621.4195	560.0372	546.2259	(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	54.8914	55.0087	55.1241	55.6729	55.7768	56.2655	56.2655	56.3570	56.0763	55.7768	55.5670	55.3494	
alpha	4.6594	4.6672	4.6749	4.7115	4.7185	4.7510	4.7510	4.7571	4.7384	4.7185	4.7045	4.6900	
util living area	0.9906	0.9822	0.9580	0.8879	0.7511	0.5666	0.4175	0.4661	0.7162	0.9279	0.9822	0.9924	(86)
Tweekday	18.5591	18.7470	19.0538	19.4062	19.6108	19.6873	19.6963	19.6973	19.6582	19.3828	18.9162	18.5302	
Tweekend	20.4034	20.4870	20.6264	20.7920	20.9035	20.9509	20.9608	20.9593	20.9276	20.7739	20.5582	20.3874	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0793	20.2065	20.4233	20.6752	20.8511	20.9246	20.9394	20.9372	20.8870	20.6510	20.3101	20.0545	(87)
Th 2	19.7545	19.7568	19.7590	19.7697	19.7716	19.7809	19.7809	19.7827	19.7774	19.7716	19.7676	19.7634	(88)
util rest of house	0.9872	0.9759	0.9431	0.8508	0.6808	0.4677	0.3040	0.3466	0.6172	0.8947	0.9747	0.9897	(89)
Tweekday	18.5591	18.7470	19.0538	19.4062	19.6108	19.6873	19.6963	19.6973	19.6582	19.3828	18.9162	18.5302	
Tweekend	18.5591	18.7470	19.0538	19.4062	19.6108	19.6873	19.6963	19.6973	19.6582	19.3828	18.9162	18.5302	
MIT 2	18.5591	18.7470	19.0538	19.4062	19.6108	19.6873	19.6963	19.6973	19.6582	19.3828	18.9162	18.5302	(90)
Living area fraction													
MIT	19.2491	19.4095	19.6754	19.9822	20.1738	20.2489	20.2606	20.2601	20.2160	19.9584	19.5489	19.2221	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2491	19.4095	19.6754	19.9822	20.1738	20.2489	20.2606	20.2601	20.2160	19.9584	19.5489	19.2221	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9737	0.9420	0.8580	0.7053	0.5067	0.3491	0.3942	0.6551	0.9006	0.9730	0.9881	(94)
Useful gains	564.9641	633.4580	697.5744	719.9506	636.2129	450.6994	297.1900	311.9315	468.7213	559.6739	544.9251	539.7394	(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													

FULL SAP CALCULATION PRINTOUT

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Month fraction	1249.6491	1210.3092	1096.7299	913.3960	697.1088	460.6770	298.5278	314.2865	500.4515	769.8843	1027.9913	1245.3562 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	509.4056	387.6440	296.9717	139.2807	45.3066	0.0000	0.0000	0.0000	0.0000	156.3965	347.8077	524.9789 (98)
Space heating requirement per m2												2407.7916 (98)
												40.6584 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.9020 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												915.8513 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	509.4056	387.6440	296.9717	139.2807	45.3066	0.0000	0.0000	0.0000	0.0000	156.3965	347.8077	524.9789 (98)
Space heating efficiency (main heating system 1)	262.9020	262.9020	262.9020	262.9020	262.9020	0.0000	0.0000	0.0000	0.0000	262.9020	262.9020	262.9020 (210)
Space heating fuel (main heating system)	193.7625	147.4481	112.9591	52.9782	17.2332	0.0000	0.0000	0.0000	0.0000	59.4885	132.2955	199.6861 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												915.8513 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												269.1890 (232)
Electricity for lighting (calculated in Appendix L)												1849.8494 (238)
Total delivered energy for all uses												

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	915.8513	13.1900	120.8008 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	13.1900	87.6883 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	13.1900	35.5060 (250)
Additional standing charges			0.0000 (251)
Total energy cost			243.9951 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9833 (257)
SAP value		86.2832
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	915.8513	0.5190	475.3268 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			820.3628 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			960.0718 (272)
CO2 emissions per m2			16.2100 (273)
EI value			87.6560
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.6290 = 5.381$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.6290 = 0.2117$, stars = 5
Water heating energy efficiency	$13.19 / 2.7142 = 4.860$, stars = 4
Water heating environmental impact	$0.519 / 2.7142 = 0.1912$, stars = 5

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2290 (36)
Total fabric heat loss							(33) + (36) = 48.6158 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.2665	81.9701	81.9701	81.5519	81.8271	81.2907	81.2907	80.9255	81.0437	81.4195	81.2907	81.8271 (39)
Average = Sum(39)m / 12 =												81.5561 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3892	1.3842	1.3842	1.3771	1.3817	1.3727	1.3727	1.3665	1.3685	1.3749	1.3727	1.3817 (40)
HLP (average)												1.3772 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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Energy content (annual)												Total = Sum (45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
Solar input (sum of months) = Sum (63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
East					9.4500	23.0580	0.6300	0.7000			0.7700	66.5924 (76)
West					4.6200	23.0580	0.6300	0.7000			0.7700	32.5563 (80)
Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385 (83)
Total gains	587.9825	654.2025	745.4889	855.9478	905.4925	927.8001	884.9085	828.5051	744.3544	642.1268	574.1582	554.9147 (84)

7. Mean internal temperature (heating season)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	55.7768	55.9785	55.9785	56.2655	56.0763	56.4463	56.4463	56.7011	56.6184	56.3570	56.4463	56.0763	
alpha	4.7185	4.7319	4.7319	4.7510	4.7384	4.7631	4.7631	4.7801	4.7746	4.7571	4.7631	4.7384	
util living area	0.9869	0.9775	0.9424	0.8377	0.6525	0.3998	0.2386	0.2828	0.5859	0.8833	0.9735	0.9895	(86)
Tweekday	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
Tweekend	20.4754	20.5462	20.6946	20.8520	20.9364	20.9612	20.9631	20.9630	20.9512	20.8397	20.6306	20.4586	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1904	20.2981	20.5286	20.7689	20.9018	20.9404	20.9430	20.9430	20.9239	20.7526	20.4232	20.1644	(87)
Th 2	19.7716	19.7755	19.7755	19.7809	19.7774	19.7843	19.7843	19.7891	19.7876	19.7827	19.7843	19.7774	(88)
util rest of house	0.9820	0.9693	0.9217	0.7864	0.5652	0.2959	0.1272	0.1650	0.4703	0.8313	0.9619	0.9856	(89)
Tweekday	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
Tweekend	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	
MIT 2	18.7339	18.8933	19.2140	19.5310	19.6655	19.7000	19.7009	19.7060	19.6958	19.5205	19.0892	18.7010	(90)
Living area fraction									fLA = Living area / (4) =			0.4539	(91)
MIT	19.3950	19.5309	19.8107	20.0928	20.2267	20.2630	20.2647	20.2674	20.2532	20.0797	19.6947	19.3653	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3950	19.5309	19.8107	20.0928	20.2267	20.2630	20.2647	20.2674	20.2532	20.0797	19.6947	19.3653	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9672	0.9224	0.8008	0.5987	0.3372	0.1713	0.2116	0.5163	0.8458	0.9609	0.9839	(94)
Useful gains	576.2908	632.7712	687.6068	685.4558	542.0817	312.8328	151.5554	175.3181	384.2738	543.0899	551.6993	545.9638	(95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)
Heat loss rate W													

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Month fracti	1167.7715	1133.7237	1000.9116	806.7800	566.7900	314.0279	151.5836	175.4008	393.3245	674.1302	942.5414	1159.1023 (97)
Space heating	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	440.0616	336.6401	233.0988	87.3535	18.3830	0.0000	0.0000	0.0000	0.0000	97.4940	281.4063	456.1750 (98)
Space heating												1950.6124 (98)
Space heating per m2											(98) / (4) =	32.9384 (99)

8c. Space cooling requirement

Not applicable

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 %)												260.6185 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												748.4550 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	440.0616	336.6401	233.0988	87.3535	18.3830	0.0000	0.0000	0.0000	0.0000	97.4940	281.4063	456.1750 (98)
Space heating efficiency (main heating system 1)	260.6185	260.6185	260.6185	260.6185	260.6185	0.0000	0.0000	0.0000	0.0000	260.6185	260.6185	260.6185 (210)
Space heating fuel (main heating system)	168.8528	129.1697	89.4406	33.5177	7.0536	0.0000	0.0000	0.0000	0.0000	37.4087	107.9763	175.0355 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												748.4550 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Total delivered energy for all uses												1682.4531 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	748.4550	19.4400	145.4996 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	19.4400	129.2389 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	19.4400	52.3303 (250)
Additional standing charges			0.0000 (251)
Total energy cost			327.0689 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	748.4550	0.5190	388.4481 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			733.4841 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			873.1932 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	748.4550	3.0700	2297.7568 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	664.8092	3.0700	2040.9641 (264)
Space and water heating			4338.7209 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Primary energy kWh/year			5165.1311 (272)
Primary energy kWh/m2/year			87.2194 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 52	-140 kg (16.0%)
U Solar photovoltaic panels	+ 12.8	-£ 355	-949 kg (129.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£52	2.36 kg/m ²	B 88 B 89
Solar photovoltaic panels	£355	16.02 kg/m ²	A 101 A 101
Total Savings	£408	18.38 kg/m ²	

Potential energy efficiency rating: A 101
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£327	£275	£52
Space heating	£145	£146	-£0
Water heating	£129	£77	£53
Lighting	£52	£52	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£327	-£80	£407
Total cost of uses	£326	-£80	£408
Delivered energy	28 kWh/m ²	-7 kWh/m ²	35 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	-0.2 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	-4 kg/m ²	18 kg/m ²
Primary energy	87 kWh/m ²	-22 kWh/m ²	109 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.2290 (36)
Total fabric heat loss (33) + (36) = 48.6158 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5934	83.4152	83.2405	82.4200	82.2665	81.5519	81.5519	81.4195	81.8271	82.2665	82.5771	82.9018 (39)
Average = Sum(39)m / 12 =												82.4193 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4116	1.4086	1.4056	1.3918	1.3892	1.3771	1.3771	1.3749	1.3817	1.3892	1.3944	1.3999 (40)
HLP (average)												1.3917 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.4277	(H8)
Utilisation factor												0.5036	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												80.7380	(H14)
Volume ratio Veff/V												0.9289	(H15)
Solar storage volume factor												0.9853	(H16)
Solar input												-791.2980	(H17)
Solar input	-22.9461	-38.2904	-65.2129	-87.3981	-107.9730	-106.1547	-104.7518	-91.5222	-71.6802	-48.9492	-27.2173	-19.2019	(63)
												-791.2980	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069	(64)
												947.6214	(64)
Total per year (kWh/year) = Sum(64)m =													
Heat gains from water heating, kWh/month													
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(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					
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497	(83)
Total gains	573.2865	650.5635	739.0618	831.6297	888.2578	875.4286	837.2624	778.2855	709.4734	619.9187	560.0372	546.2259	(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	54.8914	55.0087	55.1241	55.6729	55.7768	56.2655	56.2655	56.3570	56.0763	55.7768	55.5670	55.3494	
alpha	4.6594	4.6672	4.6749	4.7115	4.7185	4.7510	4.7510	4.7571	4.7384	4.7185	4.7045	4.6900	
util living area	0.9906	0.9822	0.9583	0.8907	0.7585	0.5745	0.4242	0.4734	0.7204	0.9284	0.9822	0.9924	(86)
Tweekday	18.5591	18.7470	19.0521	19.4007	19.6070	19.6866	19.6963	19.6972	19.6572	19.3814	18.9162	18.5302	
Tweekend	20.4034	20.4870	20.6255	20.7891	20.9010	20.9502	20.9606	20.9590	20.9267	20.7732	20.5582	20.3874	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0793	20.2065	20.4221	20.6706	20.8471	20.9235	20.9392	20.9368	20.8856	20.6499	20.3101	20.0545	(87)
Th 2	19.7545	19.7568	19.7590	19.7697	19.7716	19.7809	19.7809	19.7827	19.7774	19.7716	19.7676	19.7634	(88)
util rest of house	0.9872	0.9759	0.9435	0.8541	0.6886	0.4747	0.3090	0.3522	0.6215	0.8954	0.9747	0.9897	(89)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	18.5591	18.7470	19.0521	19.4007	19.6070	19.6866	19.6963	19.6972	19.6572	19.3814	18.9162	18.5302
Tweekend	18.5591	18.7470	19.0521	19.4007	19.6070	19.6866	19.6963	19.6972	19.6572	19.3814	18.9162	18.5302
MIT 2	18.5591	18.7470	19.0521	19.4007	19.6070	19.6866	19.6963	19.6972	19.6572	19.3814	18.9162	18.5302 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	19.2491	19.4095	19.6739	19.9771	20.1699	20.2480	20.2604	20.2598	20.2148	19.9572	19.5489	19.2221 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2491	19.4095	19.6739	19.9771	20.1699	20.2480	20.2604	20.2598	20.2148	19.9572	19.5489	19.2221 (93)

8. Space heating requirement

Utilisation	Jan 0.9855	Feb 0.9737	Mar 0.9423	Apr 0.8611	May 0.7128	Jun 0.5141	Jul 0.3548	Aug 0.4006	Sep 0.6593	Oct 0.9013	Nov 0.9730	Dec 0.9881 (94)
Useful gains	564.9641	633.4580	696.4292	716.0909	633.1399	450.0173	297.0808	311.7452	467.7699	558.7309	544.9251	539.7394 (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	1249.6491	1210.3092	1096.6028	912.9769	696.7915	460.6075	298.5152	314.2657	500.3536	769.7817	1027.9913	1245.3562 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	509.4056	387.6440	297.7291	141.7579	47.3568	0.0000	0.0000	0.0000	0.0000	157.0218	347.8077	524.9789 (98)
Space heating												2413.7018 (98)
Space heating per m2										(98) / (4) =		40.7582 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.9020 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												918.0993 (211)
Space heating requirement	Jan 509.4056	Feb 387.6440	Mar 297.7291	Apr 141.7579	May 47.3568	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 157.0218	Nov 347.8077	Dec 524.9789 (98)
Space heating efficiency (main heating system 1)	262.9020	262.9020	262.9020	262.9020	262.9020	0.0000	0.0000	0.0000	0.0000	262.9020	262.9020	262.9020 (210)
Space heating fuel (main heating system)	193.7625	147.4481	113.2472	53.9204	18.0131	0.0000	0.0000	0.0000	0.0000	59.7263	132.2955	199.6861 (211)
Water heating 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 (215)
Water heating requirement	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069 (64)
Efficiency of water heater (217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	56.7834	43.4278	35.9658	19.6653	8.8527	4.0308	2.6129	12.1515	21.7907	37.8079	49.4205	56.6317 (219)
Water heating fuel used												349.1411 (219)
Annual totals kWh/year												
Space heating fuel - main system												918.0993 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												-140.8099 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	918.0993	13.1900	121.0973 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	349.1411	13.1900	46.0517 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	269.1890	13.1900	35.5060 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			-18.5728 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	-0.0748 (257)
SAP value		101.0441

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

101 (258)
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	918.0993	0.5190	476.4936 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	349.1411	0.5190	181.2043 (264)
Space and water heating			657.6978 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-73.0804 (272)
CO2 emissions per m2			-1.2300 (273)
EI value			100.9396
EI rating			101 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			70.7600	0.0000	0.0000	140.0000	9906.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16518.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							278.9399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.2290 (36)
Total fabric heat loss						(33) + (36) =	48.6158 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.2665	81.9701	81.9701	81.5519	81.8271	81.2907	81.2907	80.9255	81.0437	81.4195	81.2907	81.8271 (39)
Average = Sum(39)m / 12 =												81.5561 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3892	1.3842	1.3842	1.3771	1.3817	1.3727	1.3727	1.3665	1.3685	1.3749	1.3727	1.3817 (40)
HLP (average)												1.3772 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1142.6174	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1919.5973	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.5111	(H8)
Utilisation factor												0.4841	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												80.7380	(H14)
Volume ratio Veff/V												0.9289	(H15)
Solar storage volume factor												0.9853	(H16)
Solar input												-804.9938	(H17)
Solar input	-25.5083	-37.1066	-63.1454	-86.9824	-104.1182	-109.5914	-107.4819	-95.4929	-74.5104	-51.3676	-29.2373	-20.4515	(63)
												-804.9938	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573	(64)
Total per year (kWh/year) = Sum(64)m =												933.9256	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(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					
East	9.4500	23.0580		0.6300		0.7000		0.7700		66.5924		(76)	
West	4.6200	23.0580		0.6300		0.7000		0.7700		32.5563		(80)	
Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385	(83)
Total gains	587.9825	654.2025	743.9881	848.4438	891.7352	913.7927	870.9011	815.4981	738.3512	640.6260	574.1582	554.9147	(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	55.7768	55.9785	55.9785	56.2655	56.0763	56.4463	56.4463	56.7011	56.6184	56.3570	56.4463	56.0763	
alpha	4.7185	4.7319	4.7319	4.7510	4.7384	4.7631	4.7631	4.7801	4.7746	4.7571	4.7631	4.7384	
util living area	0.9869	0.9775	0.9428	0.8412	0.6603	0.4058	0.2425	0.2872	0.5900	0.8841	0.9735	0.9895	(86)
Tweekday	18.7339	18.8933	19.2124	19.5271	19.6640	19.7000	19.7009	19.7060	19.6956	19.5195	19.0892	18.7010	
Tweekend	20.4754	20.5462	20.6938	20.8497	20.9350	20.9611	20.9631	20.9630	20.9509	20.8391	20.6306	20.4586	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1904	20.2981	20.5275	20.7653	20.8997	20.9402	20.9430	20.9429	20.9233	20.7517	20.4232	20.1644	(87)
Th 2	19.7716	19.7755	19.7755	19.7809	19.7774	19.7843	19.7843	19.7891	19.7876	19.7827	19.7843	19.7774	(88)
util rest of house	0.9820	0.9693	0.9221	0.7904	0.5728	0.3004	0.1292	0.1676	0.4739	0.8322	0.9619	0.9856	(89)

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Tuesday	18.7339	18.8933	19.2124	19.5271	19.6640	19.7000	19.7009	19.7060	19.6956	19.5195	19.0892	18.7010
Tuesday	18.7339	18.8933	19.2124	19.5271	19.6640	19.7000	19.7009	19.7060	19.6956	19.5195	19.0892	18.7010
MIT 2	18.7339	18.8933	19.2124	19.5271	19.6640	19.7000	19.7009	19.7060	19.6956	19.5195	19.0892	18.7010 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	19.3950	19.5309	19.8093	20.0891	20.2249	20.2629	20.2647	20.2674	20.2528	20.0788	19.6947	19.3653 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3950	19.5309	19.8093	20.0891	20.2249	20.2629	20.2647	20.2674	20.2528	20.0788	19.6947	19.3653 (93)

8. Space heating requirement

Utilisation	Jan 0.9801	Feb 0.9672	Mar 0.9228	Apr 0.8045	May 0.6063	Jun 0.3422	Jul 0.1740	Aug 0.2150	Sep 0.5200	Oct 0.8466	Nov 0.9609	Dec 0.9839 (94)
Useful gains	576.2908	632.7712	686.5635	682.5923	540.6157	312.7429	151.5528	175.3107	383.9625	542.3717	551.6993	545.9638 (95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)
Heat loss rate W	1167.7715	1133.7237	1000.7976	806.4773	566.6414	314.0178	151.5831	175.3996	393.2921	674.0541	942.5414	1159.1023 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	440.0616	336.6401	233.7902	89.1972	19.3631	0.0000	0.0000	0.0000	0.0000	97.9717	281.4063	456.1750 (98)
Space heating												1954.6052 (98)
Space heating per m2											(98) / (4) =	33.0058 (99)

8c. Space cooling requirement

Not applicable

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 %)												260.6185 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												749.9870 (211)
Space heating requirement	Jan 440.0616	Feb 336.6401	Mar 233.7902	Apr 89.1972	May 19.3631	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 97.9717	Nov 281.4063	Dec 456.1750 (98)
Space heating efficiency (main heating system 1)	260.6185	260.6185	260.6185	260.6185	260.6185	0.0000	0.0000	0.0000	0.0000	260.6185	260.6185	260.6185 (210)
Space heating fuel (main heating system)	168.8528	129.1697	89.7059	34.2252	7.4297	0.0000	0.0000	0.0000	0.0000	37.5920	107.9763	175.0355 (211)
Water heating 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 (215)
Water heating requirement	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573 (64)
Efficiency of water heater (217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	55.8393	43.8640	36.7276	19.8185	10.2730	2.7646	1.6071	10.6886	20.7479	36.9169	48.6763	56.1713 (219)
Water heating fuel used												344.0950 (219)
Annual totals kWh/year												
Space heating fuel - main system												749.9870 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1143 * 0.80) =									-1828.1879			-1828.1879 (233)
Total delivered energy for all uses												-414.9168 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	749.9870	19.4400	145.7975 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	344.0950	19.4400	66.8921 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	19.4400	9.7200 (249)
Energy for lighting	269.1890	19.4400	52.3303 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1828.1879	19.4400	-355.3997 (252)
Total energy cost			-80.6598 (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	749.9870	0.5190	389.2433 (261)

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Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	344.0950	0.5190	178.5853 (264)
Space and water heating			567.8286 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	0.5190	-948.8295 (269)
Total kg/year			-215.3418 (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	749.9870	3.0700	2302.4602 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	344.0950	3.0700	1056.3718 (264)
Space and water heating			3358.8320 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	3.0700	-5612.5368 (269)
Primary energy kWh/year			-1273.7947 (272)
Primary energy kWh/m2/year			-21.5095 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	278.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	486.21 (P1)
Transmission heat loss coefficient	48.62 (37)
Summer heat loss coefficient	534.82 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.4500	117.5071	0.6300	0.7000	0.9000	396.6609
West	4.6200	117.5071	0.6300	0.7000	0.9000	193.9231
total:						590.5840

	Jun	Jul	Aug	
Solar gains	627	591	520	(P3)
Internal gains	392	377	384	
Total summer gains	1019	968	904	(P5)
Summer gain/loss ratio	1.90	1.81	1.69	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 278.9)	0.05	0.05	0.05	
Threshold temperature	17.95	19.76	19.54	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019663	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 2, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.99
Environmental	88 B	TER	31.76
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.36
General Requirements Compliance	Pass	DFEE	57.00
		TFEE	62.48
		% DFEE<TFEE	8.77
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.76	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.99	kgCO ₂ /m ²	Pass
	-13.77 (-43.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.48	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	57.00	kWh/m ² /yr	
	-5.5 (-8.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.09 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Samsung Electronics AE050RXYDEG	
Secondary heating system	None	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.32 kWh/day Permitted by DBSCG 2.03	Pass
Primary pipework insulated	Yes	Pass

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing East	9.45 m ² , No overhang	
Windows facing West	4.62 m ² , No overhang	
Air change rate	8.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m ² K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m ² K
Window U-value	1.00	W/m ² K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019663	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 2, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.99
Environmental	88 B	TER	31.76
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.36
General Requirements Compliance	Pass	DFEE	57.00
		TFEE	62.48
		% DFEE<TFEE	8.77
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Urban						
1.0 Property Type	House, Mid-Terrace						
2.0 Number of Storeys	2						
3.0 Date Built	2022						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
	Ground Floor:		8.40 m	26.88 m ²	2.40 m		
	1st Storey:		8.40 m	32.34 m ²	3.70 m		
7.0 Living Area	26.88			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	278.94			kJ/m ² K			
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)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.20	60.00	50.40	32.32
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	70.76	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame				9.00	22.08	
Internal Wall 2	Plasterboard on timber frame				9.00	4.32	
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)
Slope	External Slope Roof	Plasterboard, insulated slope		0.14	9.00	44.66	44.66

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	26.88

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	26.88
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.14	20.00	5.46

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	26.88

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Main Wall	West							1.91	
Front Windows	Window	[1] Main Wall	West	None	0.00					4.62	
Rear Door	Solid Door	[1] Main Wall	East							2.10	
Rear Windows	Window	[1] Main Wall	East	None	0.00					9.45	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	9.90	0.300	No
Table K1 - Approved	E3 Sill	6.30	0.040	No
Table K1 - Approved	E4 Jamb	30.30	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	8.40	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	8.40	0.070	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	11.60	0.040	No
Table K1 - Approved	E18 Party wall between dwellings	20.00	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	12.80	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	15.40	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	15.40	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	7.70	0.080	No

Y-value 0.096 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	8	
Total number of L.E.L. fittings	8	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Percentage of Heat	100	%
Database Ref. No.	104361	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
	No

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

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
SAP Code	901
Immersion Only Heating Hot Water	Yes

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	170.00	L
Loss	1.32	kWh/day
Pipes insulation	Fully insulated primary pipework	

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

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
Solar water heating	£4,000 - £6,000	£52	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£355	A 101	

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000632	Issued on Date	13/06/2022
Block Name	Uxbridge Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
019662-001	1	59.22	18.70	34.49	45.79 %
019663-001	1	59.22	17.99	31.76	43.36 %
019664-001	1	59.22	17.98	31.73	43.34 %
019665-001	1	68.04	16.55	31.96	48.21 %
Totals:	4	245.7	71.22	129.94	
Average DER = 17.76 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 32.47 kgCO ₂ /m ²		45.30 %			

Block Compliance Report - DFEE

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
019662-001	1	59.22	65.79	71.59	8.11 %
019663-001	1	59.22	57.00	62.48	8.77 %
019664-001	1	59.22	56.95	62.39	8.72 %
019665-001	1	68.04	59.37	66.50	10.71 %
Totals:	4	245.7	239.10	262.95	
Average DFEE = 59.76 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 65.76 kWh/m ² /yr		9.12 %			

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 3, 1178 -1184, Uxbridge Road
HAYES, UB4 8JB

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 13/06/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

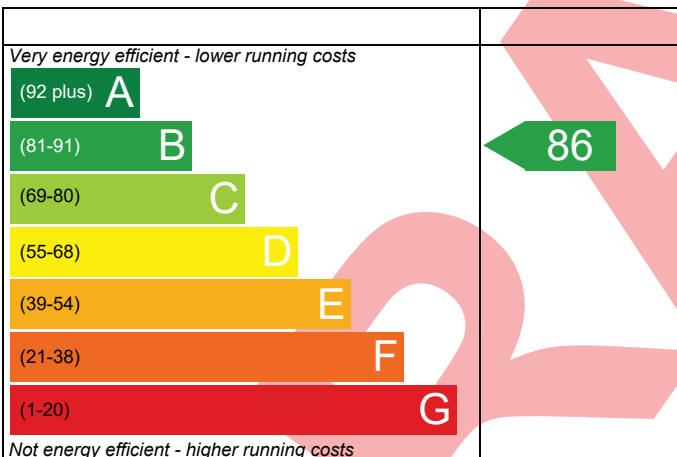
Plot 3, 1178 -1184, Uxbridge Road,
HAYES,
UB4 8JB

Dwelling type: House, Mid-Terrace
Date of assessment: 13/06/2022
Produced by: Energy Calculations Limited
Total floor area: 59.22 m²

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 SAP2012 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

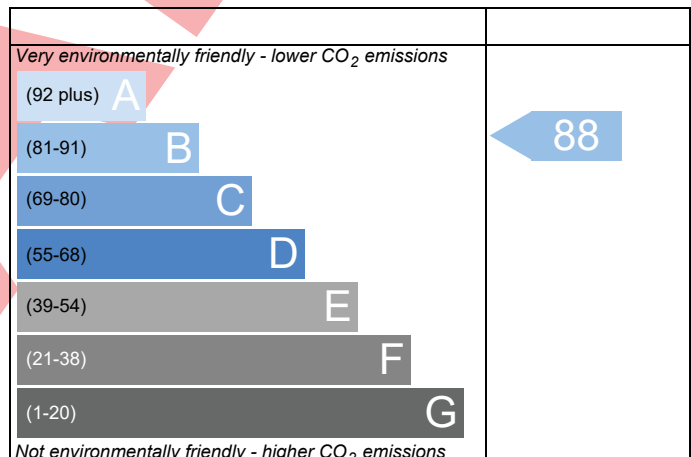


England

EU Directive
2002/91/EC

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



England

EU Directive
2002/91/EC

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.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

THERMAL BRIDGING

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019664	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 3, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.98
Environmental	88 B	TER	31.73
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.34
General Requirements Compliance	Pass	DFEE	56.95
		TFEE	62.39
		% DFEE<TFEE	8.72
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	9.90	2.97	
External wall	E3 Sill	Table K1 - Approved	0.040	6.30	0.25	
External wall	E4 Jamb	Table K1 - Approved	0.050	30.30	1.52	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	7.90	1.26	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	8.40	0.59	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	11.60	0.46	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	20.00	1.20	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	12.80	2.05	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	15.40	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Table K1 - Default	0.080	15.40	1.23	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	7.70	0.62	

Total: **12.15** W/mK:
Y-Value: **0.095** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Property Reference	019664			Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref			
Property	Plot 3, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB				
SAP Rating	86 B	DER	17.98	TER	31.73
Environmental	88 B	% DER<TER	43.34		
CO ₂ Emissions (t/year)	0.87	DFEE	56.95	TFEE	62.39
General Requirements Compliance	Pass	% DFEE<TFEE	8.72		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 59 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 31.73 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 56.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.09 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
Samsung Electronics AE050RXYDEG	

Secondary heating system:	None
---------------------------	------

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.32 kWh/day	
Permitted by DBSCG 2.03	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%		
Minimum	75%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
-----------------------------------	-----------------	----

Based on:

Overshading:	Average
Windows facing East:	9.45 m ² , No overhang
Windows facing West:	4.62 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Window U-value	1.00 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1490 (36)
Total fabric heat loss (33) + (36) = 48.5358 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5134	83.3352	83.1605	82.3400	82.1865	81.4719	81.4719	81.3395	81.7471	82.1865	82.4971	82.8218 (39)
Average = Sum(39)m / 12 =												82.3393 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4102	1.4072	1.4043	1.3904	1.3878	1.3757	1.3757	1.3735	1.3804	1.3878	1.3931	1.3985 (40)
HLP (average)												1.3904 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Energy content (annual)												Total = Sum (45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
Solar input (sum of months) = Sum (63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	346.2442	344.4491	333.5770	316.1190	298.5813	281.5053	270.2940	275.4659	284.3274	301.9698	322.2428	337.2667	(73)

6. Solar gains

[Jan]													
	Area	Solar flux		g		FF		Access		Gains			
	m2	Table 6a		or Table 6b		or Table 6c		Table 6d		W			
		W/m2											
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497	(83)
Total gains	430.6968	509.6564	605.6499	712.9211	784.8771	779.3156	744.2297	682.5696	600.7594	498.0022	427.5453	406.7164	(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	55.5028	55.6215	55.7383	56.2937	56.3989	56.8936	56.8936	56.9862	56.7020	56.3989	56.1866	55.9663	
alpha	4.7002	4.7081	4.7159	4.7529	4.7599	4.7929	4.7929	4.7991	4.7801	4.7599	4.7458	4.7311	
util living area	0.9972	0.9935	0.9803	0.9321	0.8152	0.6333	0.4740	0.5339	0.7999	0.9666	0.9942	0.9979	(86)
Tweekday	18.3633	18.5603	18.8954	19.3072	19.5760	19.6830	19.6974	19.6977	19.6348	19.2601	18.7396	18.3371	
Tweekend	20.3162	20.4029	20.5524	20.7402	20.8795	20.9447	20.9596	20.9569	20.9071	20.7122	20.4783	20.3015	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9446	20.0764	20.3092	20.5943	20.8140	20.9150	20.9376	20.9335	20.8550	20.5558	20.1854	19.9220	(87)
Th 2	19.7555	19.7578	19.7601	19.7707	19.7727	19.7820	19.7820	19.7837	19.7784	19.7727	19.7687	19.7645	(88)
util rest of house	0.9962	0.9909	0.9724	0.9055	0.7506	0.5282	0.3469	0.4001	0.7066	0.9481	0.9915	0.9971	(89)
Tweekday	18.3633	18.5603	18.8954	19.3072	19.5760	19.6830	19.6974	19.6977	19.6348	19.2601	18.7396	18.3371	
Tweekend	18.3633	18.5603	18.8954	19.3072	19.5760	19.6830	19.6974	19.6977	19.6348	19.2601	18.7396	18.3371	
MIT 2	18.3633	18.5603	18.8954	19.3072	19.5760	19.6830	19.6974	19.6977	19.6348	19.2601	18.7396	18.3371	(90)
Living area fraction													
MIT	19.0810	19.2484	19.5371	19.8914	20.1379	20.2422	20.2604	20.2586	20.1886	19.8482	19.3959	19.0565	(91)
Temperature adjustment												0.0000	
adjusted MIT	19.0810	19.2484	19.5371	19.8914	20.1379	20.2422	20.2604	20.2586	20.1886	19.8482	19.3959	19.0565	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9896	0.9706	0.9085	0.7716	0.5696	0.3977	0.4538	0.7413	0.9495	0.9903	0.9964	(94)
Useful gains	428.7037	504.3390	587.8529	647.7051	605.6269	443.9227	295.9742	309.7390	445.3420	472.8519	423.4181	405.2670	(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													

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	1234.4161	1195.7308	1084.1729	905.0320	693.4834	459.6802	298.2167	313.8584	497.7274	760.0803	1014.3720	1230.4421 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	599.4501	464.6153	369.2621	185.2753	65.3652	0.0000	0.0000	0.0000	0.0000	213.6979	425.4868	613.9303 (98)
Space heating requirement												2937.0830 (98)
Space heating per m2											(98) / (4) =	49.5961 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.6907 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1118.0764 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	599.4501	464.6153	369.2621	185.2753	65.3652	0.0000	0.0000	0.0000	0.0000	213.6979	425.4868	613.9303 (98)
Space heating efficiency (main heating system 1)	262.6907	262.6907	262.6907	262.6907	262.6907	0.0000	0.0000	0.0000	0.0000	262.6907	262.6907	262.6907 (210)
Space heating fuel (main heating system)	228.1961	176.8678	140.5691	70.5298	24.8830	0.0000	0.0000	0.0000	0.0000	81.3496	161.9725	233.7084 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												1118.0764 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												269.1890 (232)
Electricity for lighting (calculated in Appendix L)												2052.0745 (238)
Total delivered energy for all uses												

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	1118.0764	0.5190	580.2816 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			925.3176 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total CO2, kg/year			1065.0267 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9800 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.9800 ZC1
Total Floor Area	TFA	59.2200
Assumed number of occupants	N	1.9595
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.1085 ZC2
CO2 emissions from cooking, equation (L16)		2.8036 ZC3
Total CO2 emissions		37.8921 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		37.8921 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	50.4000	14.8000	35.6000	0.1800	6.4080		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5890 (36)
Total fabric heat loss						(33) + (36) =	43.3219 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	78.2995	78.1213	77.9466	77.1261	76.9726	76.2580	76.2580	76.1256	76.5332	76.9726	77.2832	77.6078 (39)
Average = Sum(39)m / 12 =												77.1254 (39)
HLP	1.3222	1.3192	1.3162	1.3024	1.2998	1.2877	1.2877	1.2855	1.2924	1.2998	1.3050	1.3105 (40)
HLP (average)												1.3024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324 (46)	
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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)
Total heat required for water heating calculated for each month	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (62)
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 (63)
Output from w/h	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274 (64)
Heat gains from water heating, kWh/month	82.4942	73.2576	78.2252	71.9108	71.7646	65.9841	65.1397	69.0397	68.1535	74.4798	76.5078	81.1124 (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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5384	13.8011	11.2238	8.4971	6.3517	5.3624	5.7942	7.5316	10.1089	12.8355	14.9809	15.9703	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	110.8793	109.0143	105.1413	99.8761	96.4578	91.6445	87.5534	92.7952	94.6577	100.1073	106.2609	109.0221	(72)
Total internal gains	352.7857	350.9575	340.0364	322.5265	304.9479	287.8531	276.6500	281.8550	290.7656	308.4599	328.7737	343.8164	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
East					7.2500	19.6403	0.6300	0.7000			0.7700	43.5168
West					3.5400	19.6403	0.6300	0.7000			0.7700	21.2482 (76)
Solar gains	64.7650	126.6941	208.6472	304.2995	372.9305	381.7607	363.4518	312.1997	242.6653	150.3333	80.7544	53.2596 (83)
Total gains	417.5507	477.6517	548.6836	626.8260	677.8784	669.6138	640.1017	594.0546	533.4309	458.7932	409.5281	397.0761 (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	52.5227	52.6425	52.7605	53.3218	53.4281	53.9288	53.9288	54.0225	53.7348	53.4281	53.2134	52.9908
alpha	4.5015	4.5095	4.5174	4.5548	4.5619	4.5953	4.5953	4.6015	4.5823	4.5619	4.5476	4.5327
util living area	0.9960	0.9921	0.9800	0.9398	0.8418	0.6732	0.5110	0.5670	0.8167	0.9647	0.9923	0.9968 (86)
MIT	19.6288	19.7940	20.0879	20.4690	20.7758	20.9423	20.9870	20.9794	20.8571	20.4475	19.9699	19.6009 (87)
Th 2	19.8235	19.8258	19.8281	19.8390	19.8410	19.8505	19.8505	19.8522	19.8468	19.8410	19.8369	19.8326 (88)
util rest of house	0.9946	0.9894	0.9728	0.9178	0.7865	0.5740	0.3842	0.4365	0.7339	0.9474	0.9891	0.9957 (89)
MIT 2	18.0214	18.2633	18.6894	19.2324	19.6297	19.8141	19.8461	19.8444	19.7374	19.2155	18.5283	17.9869 (90)
Living area fraction	18.7510	18.9581	19.3242	19.7937	20.1499	20.3262	20.3639	20.3595	20.2456	19.7747	19.1827	18.7195 (91)
MIT	18.7510	18.9581	19.3242	19.7937	20.1499	20.3262	20.3639	20.3595	20.2456	19.7747	19.1827	18.7195 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7510	18.9581	19.3242	19.7937	20.1499	20.3262	20.3639	20.3595	20.2456	19.7747	19.1827	18.7195 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9929	0.9866	0.9688	0.9168	0.8028	0.6171	0.4421	0.4961	0.7657	0.9461	0.9866	0.9943	(94)
Ext temp.	414.5749	471.2676	531.5849	574.6617	544.2266	413.2249	283.0118	294.7295	408.4361	434.0778	404.0550	394.7942	(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)
Month fracti	1131.5081	1098.2354	999.6004	840.1895	650.4138	436.6678	287.0280	301.4231	470.3450	706.1991	933.7854	1126.8293	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	533.3983	421.3224	348.2035	191.1800	79.0033	0.0000	0.0000	0.0000	0.0000	202.4582	381.4059	544.6341	(98)
Space heating per m2													(98) / (4) =

8c. Space cooling requirement

Not applicable

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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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2889.4177 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.3983	421.3224	348.2035	191.1800	79.0033	0.0000	0.0000	0.0000	0.0000	202.4582	381.4059	544.6341	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	570.4794	450.6122	372.4101	204.4706	84.4955	0.0000	0.0000	0.0000	0.0000	216.5328	407.9207	582.4964	(211)
Water heating 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	(215)
Water heating requirement	180.0831	158.8864	167.2439	150.4475	147.8135	132.6227	127.8892	139.6183	139.1474	155.9797	164.2732	175.9274	(64)
Efficiency of water heater (217)m	87.5375	87.2947	86.7269	85.4540	83.2275	79.8000	79.8000	79.8000	79.8000	85.5105	86.9887	79.8000	(216)
Fuel for water heating, kWh/month	205.7212	182.0115	192.8397	176.0567	177.6019	166.1939	160.2621	174.9602	174.3702	182.4100	188.8443	200.7588	(219)
Water heating fuel used												2182.0306	(219)
Annual totals kWh/year													
Space heating fuel - main system												2889.4177	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.4132	(232)
Total delivered energy for all uses												5420.8615	(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	2889.4177	0.2160	624.1142	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2182.0306	0.2160	471.3186	(264)
Space and water heating			1095.4328	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.4132	0.5190	142.4205	(268)
Total CO2, kg/m2/year			1276.7783	(272)
Emissions per m2 for space and water heating			18.4977	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4049	(272b)
Emissions per m2 for pumps and fans			0.6573	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.4977 * 1.55) + 2.4049 + 0.6573, rounded to 2 d.p.			31.7300	(273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			9.0000	241.9200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16444.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							277.6917 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1490 (36)
Total fabric heat loss					(33) + (36) =		48.5358 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5134	83.3352	83.1605	82.3400	82.1865	81.4719	81.4719	81.3395	81.7471	82.1865	82.4971	82.8218 (39)
Average = Sum(39)m / 12 =												82.3393 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4102	1.4072	1.4043	1.3904	1.3878	1.3757	1.3757	1.3735	1.3804	1.3878	1.3931	1.3985 (40)
HLP (average)												1.3904 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

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Energy content (annual)	Total = Sum(45)m = 1270.3238 (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												
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)
Heat gains from water heating, kWh/month												
27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	27.1043	(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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2426	13.5383	11.0101	8.3354	6.2308	5.2603	5.6839	7.3882	9.9164	12.5912	14.6957	15.6662	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	(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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305	(72)
Total internal gains	276.2281	275.1060	265.6317	250.0740	233.7699	218.4311	208.6962	211.9763	220.1657	235.8413	253.8935	267.9208	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
East				9.4500	19.6403	0.6300	0.7000	0.7700			56.7219 (76)	
West				4.6200	19.6403	0.6300	0.7000	0.7700			27.7307 (80)	

Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497 (83)
Total gains	360.6807	440.3133	537.7046	646.8760	720.0657	716.2414	682.6319	619.0801	536.5977	431.8737	359.1960	337.3706 (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	54.6981	54.8151	54.9302	55.4776	55.5812	56.0688	56.0688	56.1600	55.8800	55.5812	55.3720	55.1549	
util living area	4.6465	4.6543	4.6620	4.6985	4.7054	4.7379	4.7379	4.7440	4.7253	4.7054	4.6915	4.6770	
0.9986	0.9962	0.9870	0.9496	0.8484	0.6755	0.5130	0.5812	0.8453	0.9797	0.9970	0.9990	0.9990	(86)
MIT	19.5545	19.7376	20.0558	20.4645	20.7848	20.9472	20.9884	20.9798	20.8449	20.3947	19.8951	19.5240	(87)
Th 2	19.7555	19.7578	19.7601	19.7707	19.7727	19.7820	19.7820	19.7837	19.7784	19.7727	19.7687	19.7645	(88)
util rest of house	0.9981	0.9947	0.9817	0.9285	0.7894	0.5687	0.3774	0.4392	0.7607	0.9676	0.9956	0.9986	(89)
MIT 2	18.4550	18.6392	18.9560	19.3579	19.6394	19.7611	19.7797	19.7791	19.6998	19.3015	18.8054	18.4315	(90)
Living area fraction													
MIT	18.9540	19.1377	19.4552	19.8602	20.1593	20.2994	20.3283	20.3241	20.2195	19.7977	19.3000	18.9274	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9540	19.1377	19.4552	19.8602	20.1593	20.2994	20.3283	20.3241	20.2195	19.7977	19.3000	18.9274	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9937	0.9800	0.9303	0.8100	0.6164	0.4396	0.5045	0.7952	0.9679	0.9949	0.9982	(94)
Useful gains	359.8087	437.5577	526.9451	601.7896	583.2197	441.4905	300.0810	312.3566	426.7010	418.0162	357.3527	336.7718	(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													
	1223.8095	1186.5052	1077.3628	902.4609	695.2395	464.3439	303.7526	319.1824	500.2548	755.9270	1006.4625	1219.7452	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	642.8166	503.2927	409.5108	216.4834	83.3427	0.0000	0.0000	0.0000	0.0000	251.4056	467.3590	656.9322	(98)
Space heating													3231.1430 (98)
Space heating per m2											(98) / (4) =	54.5617	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	765.8357	602.8919	618.1805	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8888	0.9384	0.9123	0.0000	0.0000	0.0000	0.0000 (101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	680.6550	565.7616	563.9526	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	910.4077	869.6873	796.5346	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	165.4219	226.1207	173.0411	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												564.5837 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.3555	56.5302	43.2603	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.1459 (107)
Space cooling per m2												2.3834 (108)
Energy for space heating												54.5617 (99)
Energy for space cooling												2.3834 (108)
Total												56.9451 (109)
Dwelling Fabric Energy Efficiency (DFEE)												56.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			10.7900	1.3258	14.3049		(27)
Main Floor			26.8800	0.1300	3.4944		(28a)
Exposed Floor			5.4600	0.1300	0.7098		(28b)
Main Wall	50.4000	14.8000	35.6000	0.1800	6.4080		(29a)
Slope	44.6600		44.6600	0.1300	5.8058		(30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5890 (36)
Total fabric heat loss						(33) + (36) =	43.3219 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	78.2995	78.1213	77.9466	77.1261	76.9726	76.2580	76.2580	76.1256	76.5332	76.9726	77.2832	77.6078 (39)
Average = Sum(39)m / 12 =												77.1254 (39)
HLP	1.3222	1.3192	1.3162	1.3024	1.2998	1.2877	1.2877	1.2855	1.2924	1.2998	1.3050	1.3105 (40)
HLP (average)												1.3024 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy content (annual)	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1270.3238 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Heat gains from water heating, kWh/month	27.9874	24.4780	25.2591	22.0215	21.1301	18.2337	16.8962	19.3886	19.6202	22.8654	24.9594	27.1043 (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	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748	97.9748 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5384	13.8011	11.2238	8.4971	6.3517	5.3624	5.7942	7.5316	10.1089	12.8355	14.9809	15.9703 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	170.9755	172.7497	168.2788	158.7608	146.7460	135.4538	127.9099	126.1357	130.6066	140.1246	152.1394	163.4316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975	32.7975 (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)	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799 (71)
Water heating gains (Table 5)	37.6175	36.4255	33.9503	30.5854	28.4007	25.3246	22.7099	26.0600	27.2503	30.7331	34.6658	36.4305 (72)
Total internal gains	276.5239	275.3688	265.8454	250.2357	233.8909	218.5332	208.8065	212.1197	220.3582	236.0857	254.1787	268.2249 (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	
East				7.2500	19.6403		0.6300		0.7000		0.7700	43.5168 (76)
West				3.5400	19.6403		0.6300		0.7000		0.7700	21.2482 (80)

Solar gains	64.7650	126.6941	208.6472	304.2995	372.9305	381.7607	363.4518	312.1997	242.6653	150.3333	80.7544	53.2596 (83)
Total gains	341.2889	402.0629	474.4926	554.5353	606.8213	600.2939	572.2583	524.3194	463.0235	386.4190	334.9330	321.4845 (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	52.5227	52.6425	52.7605	53.3218	53.4281	53.9288	53.9288	54.0225	53.7348	53.4281	53.2134	52.9908
alpha	4.5015	4.5095	4.5174	4.5548	4.5619	4.5953	4.5953	4.6015	4.5823	4.5619	4.5476	4.5327
util living area	0.9983	0.9960	0.9884	0.9599	0.8808	0.7274	0.5644	0.6292	0.8703	0.9810	0.9966	0.9987 (86)
MIT	19.5132	19.6811	19.9822	20.3813	20.7200	20.9205	20.9805	20.9686	20.8066	20.3494	19.8580	19.4857 (87)
Th 2	19.8235	19.8258	19.8281	19.8390	19.8410	19.8505	19.8505	19.8522	19.8468	19.8410	19.8369	19.8326 (88)
util rest of house	0.9976	0.9946	0.9840	0.9439	0.8331	0.6284	0.4279	0.4906	0.7991	0.9708	0.9951	0.9982 (89)
MIT 2	18.4780	18.6472	18.9477	19.3448	19.6541	19.8147	19.8458	19.8436	19.7389	19.3220	18.8328	18.4577 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	18.9479	19.1165	19.4173	19.8153	20.1379	20.3166	20.3609	20.3543	20.2235	19.7884	19.2981	18.9243 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9479	19.1165	19.4173	19.8153	20.1379	20.3166	20.3609	20.3543	20.2235	19.7884	19.2981	18.9243 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9934	0.9820	0.9435	0.8469	0.6713	0.4905	0.5542	0.8258	0.9702	0.9942	0.9977 (94)
Useful gains	340.2641	399.4277	465.9740	523.1868	513.9180	402.9980	280.6848	290.5785	382.3594	374.8971	332.9744	320.7474 (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	1146.9245	1110.6083	1006.8568	841.8519	649.4875	435.9373	286.7950	301.0201	468.6545	707.2518	942.7075	1142.7239 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	600.1553	477.9134	402.4168	229.4389	100.8637	0.0000	0.0000	0.0000	0.0000	247.2719	439.0079	611.5506 (98)
Space heating												3108.6184 (98)
Space heating per m2										(98) / (4) =		52.4927 (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	716.8248	564.3089	578.5547	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8518	0.9128	0.8837	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	610.5655	515.0735	511.2475	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.0205	740.8260	685.9663	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	118.4077	167.9598	129.9908	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												416.3583 (104)

FULL SAP CALCULATION PRINTOUT

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Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.6019	41.9900	32.4977	0.0000	0.0000	0.0000 (107)
Space cooling											104.0896 (107)
Space cooling per m2											1.7577 (108)
Energy for space heating											52.4927 (99)
Energy for space cooling											1.7577 (108)
Total											54.2504 (109)
Target Fabric Energy Efficiency (TFEE)											62.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1490 (36)
Total fabric heat loss (33) + (36) = 48.5358 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.1865	81.8901	81.8901	81.4719	81.7471	81.2107	81.2107	80.8455	80.9637	81.3395	81.2107	81.7471 (39)
Average = Sum(39)m / 12 =												81.4761 (39)
HLP	1.3878	1.3828	1.3828	1.3757	1.3804	1.3713	1.3713	1.3652	1.3672	1.3735	1.3713	1.3804 (40)
HLP (average)												1.3758 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
												Total per year (kWh/year) = Sum(64)m =	1804.3918 (64)
RHI water heating demand												1804	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(73)

6. Solar gains

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

East					9.4500	23.0580	0.6300	0.7000			0.7700			66.5924
West					4.6200	23.0580	0.6300	0.7000			0.7700			32.5563 (80)

Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385 (83)		
Total gains	587.9825	654.2025	745.4889	855.9478	905.4925	927.8001	884.9085	828.5051	744.3544	642.1268	574.1582	554.9147 (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	56.3989	56.6030	56.6030	56.8936	56.7020	57.0765	57.0765	57.3344	57.2507	56.9862	57.0765	56.7020	
alpha	4.7599	4.7735	4.7735	4.7929	4.7801	4.8051	4.8051	4.8223	4.8167	4.7991	4.8051	4.7801	
util living area	0.9873	0.9780	0.9433	0.8386	0.6527	0.3996	0.2384	0.2825	0.5860	0.8843	0.9741	0.9899	(86)
Tweekday	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
Tweekend	20.4805	20.5508	20.6981	20.8542	20.9374	20.9616	20.9634	20.9634	20.9520	20.8418	20.6344	20.4637	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1982	20.3051	20.5341	20.7724	20.9035	20.9410	20.9435	20.9435	20.9250	20.7559	20.4291	20.1723	(87)
Th 2	19.7727	19.7765	19.7765	19.7820	19.7784	19.7854	19.7854	19.7901	19.7886	19.7837	19.7854	19.7784	(88)
util rest of house	0.9825	0.9699	0.9226	0.7872	0.5653	0.2957	0.1271	0.1649	0.4702	0.8322	0.9627	0.9860	(89)
Tweekday	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
Tweekend	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
MIT 2	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	(90)
Living area fraction													
MIT	19.4046	19.5397	19.8174	20.0972	20.2289	20.2643	20.2659	20.2686	20.2549	20.0839	19.7020	19.3750	(92)
Temperature adjustment													
adjusted MIT	19.4046	19.5397	19.8174	20.0972	20.2289	20.2643	20.2659	20.2686	20.2549	20.0839	19.7020	19.3750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9680	0.9234	0.8018	0.5989	0.3370	0.1712	0.2115	0.5163	0.8469	0.9617	0.9843	(94)
Useful gains	576.6122	633.2509	688.3939	686.2859	542.2948	312.6852	151.5050	175.2469	384.2943	543.7922	552.1614	546.2287	(95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1167.4242	1133.3304	1000.4868	806.3452	566.4194	313.8230	151.5311	175.3242	393.0714	673.8079	942.2028	1158.7696 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
Space heating	439.5641	336.0534	232.1971	86.4427	17.9487	0.0000	0.0000	0.0000	0.0000	96.7316	280.8298	455.7304 (98)
Space heating												1945.4979 (98)
RHI space heating demand												1945 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1490 (36)
Total fabric heat loss					(33) + (36) =		48.5358 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5134	83.3352	83.1605	82.3400	82.1865	81.4719	81.4719	81.3395	81.7471	82.1865	82.4971	82.8218 (39)
Average = Sum(39)m / 12 =												82.3393 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4102	1.4072	1.4043	1.3904	1.3878	1.3757	1.3757	1.3735	1.3804	1.3878	1.3931	1.3985 (40)
HLP (average)												1.3904 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
												Total per year (kWh/year) = Sum(64)m =	1804.3918 (64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(73)

6. Solar gains

[Jan]													
	Area	Solar flux		Specific data		FF		Access		Gains			
	m2	Table 6a		or Table 6b		or Table 6c		factor		W			
		W/m2						Table 6d					
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497	(83)
Total gains	573.2865	650.5635	740.5626	839.1337	902.0151	889.4361	851.2699	791.2924	715.4766	621.4195	560.0372	546.2259	(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	55.5028	55.6215	55.7383	56.2937	56.3989	56.8936	56.8936	56.9862	56.7020	56.3989	56.1866	55.9663	
alpha	4.7002	4.7081	4.7159	4.7529	4.7599	4.7929	4.7929	4.7991	4.7801	4.7599	4.7458	4.7311	
util living area	0.9909	0.9827	0.9587	0.8888	0.7517	0.5666	0.4172	0.4659	0.7167	0.9288	0.9827	0.9927	(86)
Tweekday	18.5714	18.7580	19.0627	19.4125	19.6146	19.6894	19.6982	19.6992	19.6611	19.3888	18.9257	18.5427	
Tweekend	20.4090	20.4920	20.6304	20.7948	20.9052	20.9516	20.9612	20.9598	20.9288	20.7766	20.5625	20.3931	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0879	20.2142	20.4296	20.6796	20.8537	20.9257	20.9401	20.9379	20.8888	20.6552	20.3168	20.0633	(87)
Th 2	19.7555	19.7578	19.7601	19.7707	19.7727	19.7820	19.7820	19.7837	19.7784	19.7727	19.7687	19.7645	(88)
util rest of house	0.9876	0.9765	0.9440	0.8517	0.6812	0.4676	0.3038	0.3464	0.6174	0.8957	0.9753	0.9900	(89)
Tweekday	18.5714	18.7580	19.0627	19.4125	19.6146	19.6894	19.6982	19.6992	19.6611	19.3888	18.9257	18.5427	
Tweekend	18.5714	18.7580	19.0627	19.4125	19.6146	19.6894	19.6982	19.6992	19.6611	19.3888	18.9257	18.5427	
MIT 2	18.5714	18.7580	19.0627	19.4125	19.6146	19.6894	19.6982	19.6992	19.6611	19.3888	18.9257	18.5427	(90)
Living area fraction													
MIT	19.2597	19.4190	19.6831	19.9876	20.1770	20.2506	20.2619	20.2614	20.2183	19.9636	19.5571	19.2329	(91)
Temperature adjustment												0.0000	
adjusted MIT	19.2597	19.4190	19.6831	19.9876	20.1770	20.2506	20.2619	20.2614	20.2183	19.9636	19.5571	19.2329	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9859	0.9744	0.9429	0.8591	0.7060	0.5067	0.3490	0.3941	0.6556	0.9018	0.9737	0.9885	(94)
Useful gains	565.2196	633.8803	698.2885	720.8845	636.7800	450.6961	297.0644	311.8302	469.0437	560.3691	545.2945	539.9514	(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													

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Month fracti	1249.3393	1209.9428	1096.3160	912.9572	696.6945	460.3647	298.3404	314.0879	500.1575	769.5610	1027.6769	1245.0522 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	508.9851	387.1140	296.1325	138.2923	44.5764	0.0000	0.0000	0.0000	0.0000	155.6388	347.3153	524.5950 (98)
Space heating												2402.6494 (98)
Space heating per m2											(98) / (4) =	40.5716 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.6907 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												914.6304 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	508.9851	387.1140	296.1325	138.2923	44.5764	0.0000	0.0000	0.0000	0.0000	155.6388	347.3153	524.5950 (98)
Space heating efficiency (main heating system 1)	262.6907	262.6907	262.6907	262.6907	262.6907	0.0000	0.0000	0.0000	0.0000	262.6907	262.6907	262.6907 (210)
Space heating fuel (main heating system)	193.7583	147.3649	112.7305	52.6445	16.9692	0.0000	0.0000	0.0000	0.0000	59.2479	132.2145	199.7006 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												914.6304 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												269.1890 (232)
Electricity for lighting (calculated in Appendix L)												1848.6286 (238)
Total delivered energy for all uses												

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	914.6304	13.1900	120.6398 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	13.1900	87.6883 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	13.1900	35.5060 (250)
Additional standing charges			0.0000 (251)
Total energy cost			243.8341 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9826 (257)
SAP value		86.2922
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	914.6304	0.5190	474.6932 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			819.7292 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			959.4382 (272)
CO2 emissions per m2			16.2000 (273)
EI value			87.6641
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.6269 = 5.385$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.6269 = 0.2119$, stars = 5
Water heating energy efficiency	$13.19 / 2.7142 = 4.860$, stars = 4
Water heating environmental impact	$0.519 / 2.7142 = 0.1912$, stars = 5

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1490 (36)
Total fabric heat loss (33) + (36) = 48.5358 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.1865	81.8901	81.8901	81.4719	81.7471	81.2107	81.2107	80.8455	80.9637	81.3395	81.2107	81.7471 (39)
Average = Sum(39)m / 12 =												81.4761 (39)
HLP	1.3878	1.3828	1.3828	1.3757	1.3804	1.3713	1.3713	1.3652	1.3672	1.3735	1.3713	1.3804 (40)
HLP (average)												1.3758 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9595 (42)
Average daily hot water use (litres/day)												80.7380 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(62)
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	75.8104	69.5739	69.3498	63.6472	62.7249	66.6249	65.8166	72.0650	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	101.8956	96.6304	93.2121	88.3988	84.3077	89.5495	91.4120	96.8616	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	468.4898	442.3317	415.7193	391.6258	377.3342	384.1886	399.0446	425.3872	454.7347	476.7762	(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					
East	9.4500	23.0580		0.6300		0.7000		0.7700		66.5924		(76)	
West	4.6200	23.0580		0.6300		0.7000		0.7700		32.5563		(80)	
Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385	(83)
Total gains	587.9825	654.2025	745.4889	855.9478	905.4925	927.8001	884.9085	828.5051	744.3544	642.1268	574.1582	554.9147	(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	56.3989	56.6030	56.6030	56.8936	56.7020	57.0765	57.0765	57.3344	57.2507	56.9862	57.0765	56.7020	
alpha	4.7599	4.7735	4.7735	4.7929	4.7801	4.8051	4.8051	4.8223	4.8167	4.7991	4.8051	4.7801	
util living area	0.9873	0.9780	0.9433	0.8386	0.6527	0.3996	0.2384	0.2825	0.5860	0.8843	0.9741	0.9899	(86)
Tweekday	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
Tweekend	20.4805	20.5508	20.6981	20.8542	20.9374	20.9616	20.9634	20.9634	20.9520	20.8418	20.6344	20.4637	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1982	20.3051	20.5341	20.7724	20.9035	20.9410	20.9435	20.9435	20.9250	20.7559	20.4291	20.1723	(87)
Th 2	19.7727	19.7765	19.7765	19.7820	19.7784	19.7854	19.7854	19.7901	19.7886	19.7837	19.7854	19.7784	(88)
util rest of house	0.9825	0.9699	0.9226	0.7872	0.5653	0.2957	0.1271	0.1649	0.4702	0.8322	0.9627	0.9860	(89)
Tweekday	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
Tweekend	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	
MIT 2	18.7450	18.9034	19.2218	19.5360	19.6683	19.7018	19.7027	19.7077	19.6980	19.5253	19.0976	18.7124	(90)
Living area fraction													
MIT	19.4046	19.5397	19.8174	20.0972	20.2289	20.2643	20.2659	20.2686	20.2549	20.0839	19.7020	19.3750	(91)
Temperature adjustment												0.0000	
adjusted MIT	19.4046	19.5397	19.8174	20.0972	20.2289	20.2643	20.2659	20.2686	20.2549	20.0839	19.7020	19.3750	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	576.6122	632.2509	688.3939	686.2859	542.2948	312.6852	151.5050	175.2469	384.2943	543.7922	552.1614	546.2287	(94)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)
Heat loss rate W													

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Energy Calculations Ltd
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Month fraction	1167.4242	1133.3304	1000.4868	806.3452	566.4194	313.8230	151.5311	175.3242	393.0714	673.8079	942.2028	1158.7696 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	439.5641	336.0534	232.1971	86.4427	17.9487	0.0000	0.0000	0.0000	0.0000	96.7316	280.8298	455.7304 (98)
Space heating requirement												1945.4979 (98)
Space heating per m2											(98) / (4) =	32.8520 (99)

8c. Space cooling requirement

Not applicable

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 %)												260.4065 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												747.1005 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	439.5641	336.0534	232.1971	86.4427	17.9487	0.0000	0.0000	0.0000	0.0000	96.7316	280.8298	455.7304 (98)
Space heating efficiency (main heating system 1)	260.4065	260.4065	260.4065	260.4065	260.4065	0.0000	0.0000	0.0000	0.0000	260.4065	260.4065	260.4065 (210)
Space heating fuel (main heating system)	168.7992	129.0496	89.1672	33.1953	6.8926	0.0000	0.0000	0.0000	0.0000	37.1464	107.8429	175.0073 (211)
Water heating 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 (215)
Water heating requirement	177.0646	156.1600	164.2254	147.5264	144.7950	129.7016	124.8707	136.5998	136.2263	152.9612	161.3520	172.9088 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	65.2376	57.5355	60.5071	54.3545	53.3482	47.7872	46.0073	50.3287	50.1911	56.3570	59.4485	63.7064 (219)
Water heating fuel used												664.8092 (219)
Annual totals kWh/year												
Space heating fuel - main system												747.1005 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Total delivered energy for all uses												1681.0986 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	747.1005	19.4400	145.2363 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	664.8092	19.4400	129.2389 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	269.1890	19.4400	52.3303 (250)
Additional standing charges			0.0000 (251)
Total energy cost			326.8056 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	747.1005	0.5190	387.7451 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	664.8092	0.5190	345.0360 (264)
Space and water heating			732.7811 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Total kg/year			872.4902 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	747.1005	3.0700	2293.5984 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	664.8092	3.0700	2040.9641 (264)
Space and water heating			4334.5625 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Primary energy kWh/year			5160.9727 (272)
Primary energy kWh/m2/year			87.1492 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 52	-140 kg (16.0%)
U Solar photovoltaic panels	+ 12.8	-£ 355	-949 kg (129.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£52	2.36 kg/m ²	B 88 B 89
Solar photovoltaic panels	£355	16.02 kg/m ²	A 101 A 101
Total Savings	£408	18.38 kg/m ²	

Potential energy efficiency rating: A 101
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£327	£274	£52
Space heating	£145	£146	-£0
Water heating	£129	£77	£53
Lighting	£52	£52	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£327	-£81	£407
Total cost of uses	£326	-£80	£408
Delivered energy	28 kWh/m ²	-7 kWh/m ²	35 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	-0.2 tonnes	1.1 tonnes
CO2 emissions per m ²	15 kg/m ²	-4 kg/m ²	18 kg/m ²
Primary energy	87 kWh/m ²	-22 kWh/m ²	109 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3048 (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	0.3886	0.3810	0.3734	0.3353	0.3277	0.2896	0.2896	0.2819	0.3048	0.3277	0.3429	0.3581 (22b)
Effective ac	0.5755	0.5726	0.5697	0.5562	0.5537	0.5419	0.5419	0.5397	0.5465	0.5537	0.5588	0.5641 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1490 (36)
Total fabric heat loss (33) + (36) = 48.5358 (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	34.9776	34.7994	34.6247	33.8042	33.6507	32.9360	32.9360	32.8037	33.2113	33.6507	33.9612	34.2859 (38)
Heat transfer coeff	83.5134	83.3352	83.1605	82.3400	82.1865	81.4719	81.4719	81.3395	81.7471	82.1865	82.4971	82.8218 (39)
Average = Sum(39)m / 12 =												82.3393 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4102	1.4072	1.4043	1.3904	1.3878	1.3757	1.3757	1.3735	1.3804	1.3878	1.3931	1.3985 (40)
HLP (average)												1.3904 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.4277	(H8)
Utilisation factor												0.5036	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												80.7380	(H14)
Volume ratio Veff/V												0.9289	(H15)
Solar storage volume factor												0.9853	(H16)
Solar input												-791.2980	(H17)
Solar input	-22.9461	-38.2904	-65.2129	-87.3981	-107.9730	-106.1547	-104.7518	-91.5222	-71.6802	-48.9492	-27.2173	-19.2019	(63)
												-791.2980	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069	(64)
Total per year (kWh/year) = Sum(64)m =												947.6214	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(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					
East	9.4500	19.6403		0.6300		0.7000		0.7700		56.7219		(76)	
West	4.6200	19.6403		0.6300		0.7000		0.7700		27.7307		(80)	
Solar gains	84.4526	165.2073	272.0729	396.8020	486.2958	497.8103	473.9357	407.1038	316.4320	196.0324	105.3025	69.4497	(83)
Total gains	573.2865	650.5635	739.0618	831.6297	888.2578	875.4286	837.2624	778.2855	709.4734	619.9187	560.0372	546.2259	(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	55.5028	55.6215	55.7383	56.2937	56.3989	56.8936	56.8936	56.9862	56.7020	56.3989	56.1866	55.9663	
alpha	4.7002	4.7081	4.7159	4.7529	4.7599	4.7929	4.7929	4.7991	4.7801	4.7599	4.7458	4.7311	
util living area	0.9909	0.9827	0.9590	0.8916	0.7591	0.5745	0.4239	0.4732	0.7209	0.9293	0.9827	0.9927	(86)
Tweekday	18.5714	18.7580	19.0610	19.4070	19.6109	19.6888	19.6981	19.6991	19.6600	19.3874	18.9257	18.5427	
Tweekend	20.4090	20.4920	20.6296	20.7919	20.9026	20.9509	20.9610	20.9595	20.9279	20.7759	20.5625	20.3931	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0879	20.2142	20.4283	20.6751	20.8497	20.9247	20.9399	20.9375	20.8875	20.6541	20.3168	20.0633	(87)
Th 2	19.7555	19.7578	19.7601	19.7707	19.7727	19.7820	19.7820	19.7837	19.7784	19.7727	19.7687	19.7645	(88)
util rest of house	0.9876	0.9765	0.9444	0.8551	0.6890	0.4746	0.3089	0.3521	0.6217	0.8964	0.9753	0.9900	(89)

FULL SAP CALCULATION PRINTOUT

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SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	18.5714	18.7580	19.0610	19.4070	19.6109	19.6888	19.6981	19.6991	19.6600	19.3874	18.9257	18.5427
Tweekend	18.5714	18.7580	19.0610	19.4070	19.6109	19.6888	19.6981	19.6991	19.6600	19.3874	18.9257	18.5427
MIT 2	18.5714	18.7580	19.0610	19.4070	19.6109	19.6888	19.6981	19.6991	19.6600	19.3874	18.9257	18.5427 (90)
Living area fraction										fLA = Living area / (4) =		0.4539 (91)
MIT	19.2597	19.4190	19.6816	19.9826	20.1732	20.2498	20.2617	20.2612	20.2172	19.9624	19.5571	19.2329 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2597	19.4190	19.6816	19.9826	20.1732	20.2498	20.2617	20.2612	20.2172	19.9624	19.5571	19.2329 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9859	0.9744	0.9433	0.8622	0.7134	0.5141	0.3547	0.4004	0.6598	0.9024	0.9737	0.9885 (94)
Useful gains	565.2196	633.8803	697.1402	717.0197	633.7251	450.0283	296.9592	311.6499	468.1010	559.4238	545.2945	539.9514 (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	1249.3393	1209.9428	1096.1897	912.5413	696.3819	460.2972	298.3284	314.0680	500.0613	769.4591	1027.6769	1245.0522 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	508.9851	387.1140	296.8929	140.7756	46.6166	0.0000	0.0000	0.0000	0.0000	156.2662	347.3153	524.5950 (98)
Space heating												2408.5608 (98)
Space heating per m2										(98) / (4) =		40.6714 (99)

8c. Space cooling requirement

Not applicable

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 %)												262.6907 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												916.8808 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	508.9851	387.1140	296.8929	140.7756	46.6166	0.0000	0.0000	0.0000	0.0000	156.2662	347.3153	524.5950 (98)
Space heating efficiency (main heating system 1)	262.6907	262.6907	262.6907	262.6907	262.6907	0.0000	0.0000	0.0000	0.0000	262.6907	262.6907	262.6907 (210)
Space heating fuel (main heating system)	193.7583	147.3649	113.0199	53.5899	17.7458	0.0000	0.0000	0.0000	0.0000	59.4868	132.2145	199.7006 (211)
Water heating 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 (215)
Water heating												
Water heating requirement	154.1185	117.8696	97.6167	53.3747	24.0277	10.9401	7.0919	32.9811	59.1432	102.6163	134.1347	153.7069 (64)
Efficiency of water heater (217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	56.7834	43.4278	35.9658	19.6653	8.8527	4.0308	2.6129	12.1515	21.7907	37.8079	49.4205	56.6317 (219)
Water heating fuel used												349.1411 (219)
Annual totals kWh/year												
Space heating fuel - main system												916.8808 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												-142.0285 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	916.8808	13.1900	120.9366 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	349.1411	13.1900	46.0517 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	269.1890	13.1900	35.5060 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			-18.7336 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	-0.0755 (257)
SAP value		101.0532

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

101 (258)
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	916.8808	0.5190	475.8611 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	349.1411	0.5190	181.2043 (264)
Space and water heating			657.0654 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-73.7128 (272)
CO2 emissions per m2			-1.2400 (273)
EI value			100.9478
EI rating			101 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.8800 (1b)	x 2.4000 (2b)	= 64.5120 (1b) - (3b)
First floor	32.3400 (1c)	x 3.7000 (2c)	= 119.6580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	59.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.1700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.1086 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3586 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3048 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3277	0.3124	0.3124	0.2896	0.3048	0.2743	0.2743	0.2515	0.2591	0.2819	0.2743	0.3048 (22b)
Effective ac	0.5537	0.5488	0.5488	0.5419	0.5465	0.5376	0.5376	0.5316	0.5336	0.5397	0.5376	0.5465 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			14.0700	0.9615	13.5288		(27)
Main Floor			26.8800	0.1400	3.7632	110.0000	2956.8000 (28a)
Exposed Floor			5.4600	0.1400	0.7644	20.0000	109.2000 (28b)
Main Wall	50.4000	18.0800	32.3200	0.2000	6.4640	60.0000	1939.2000 (29a)
Slope	44.6600		44.6600	0.1400	6.2524	9.0000	401.9400 (30)
Total net area of external elements Aum(A, m ²)			127.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.3868		(33)
Party Wall 1			71.9600	0.0000	0.0000	140.0000	10074.4000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			26.8800			18.0000	483.8400 (32d)
Internal Ceiling 1			26.8800			18.0000	483.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16686.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 281.7768 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.1490 (36)
Total fabric heat loss (33) + (36) = 48.5358 (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	33.6507	33.3542	33.3542	32.9360	33.2113	32.6749	32.6749	32.3096	32.4279	32.8037	32.6749	33.2113 (38)
Heat transfer coeff	82.1865	81.8901	81.8901	81.4719	81.7471	81.2107	81.2107	80.8455	80.9637	81.3395	81.2107	81.7471 (39)
Average = Sum(39)m / 12 =												81.4761 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3878	1.3828	1.3828	1.3757	1.3804	1.3713	1.3713	1.3652	1.3672	1.3735	1.3713	1.3804 (40)
HLP (average)												1.3758 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.9595 (42)
Average daily hot water use (litres/day) 80.7380 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.8118	85.5823	82.3528	79.1233	75.8938	72.6642	72.6642	75.8938	79.1233	82.3528	85.5823	88.8118 (44)
Energy conte	131.7054	115.1904	118.8662	103.6304	99.4358	85.8056	79.5115	91.2406	92.3303	107.6020	117.4560	127.5496 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1270.3238 (45)
Distribution loss (46)m = 0.15 x (45)m													
	19.7558	17.2786	17.8299	15.5446	14.9154	12.8708	11.9267	13.6861	13.8495	16.1403	17.6184	19.1324	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage													
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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)
Total heat required for water heating calculated for each month													
	177.0646	156.1600	162.8296	140.7728	132.0007	117.0948	111.8437	124.5033	130.8234	151.5655	161.3520	172.9088	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1142.6174	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1919.5973	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.5111	(H8)
Utilisation factor												0.4841	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												80.7380	(H14)
Volume ratio Veff/V												0.9289	(H15)
Solar storage volume factor												0.9853	(H16)
Solar input												-804.9938	(H17)
Solar input	-25.5083	-37.1066	-63.1454	-86.9824	-104.1182	-109.5914	-107.4819	-95.4929	-74.5104	-51.3676	-29.2373	-20.4515	(63)
Solar input (sum of months) = Sum(63)m =												-804.9938	(63)
Output from w/h													
	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573	(64)
Total per year (kWh/year) = Sum(64)m =												933.9256	(64)
Heat gains from water heating, kWh/month													
	80.0794	71.0765	74.6938	64.1710	59.1143	53.5618	52.3034	56.9477	61.4943	70.9484	74.1709	78.6976	(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	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	117.5698	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.1065	33.8458	27.5253	20.8384	15.5770	13.1507	14.2098	18.4705	24.7910	31.4779	36.7393	39.1656	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1874	257.8354	251.1624	236.9564	219.0239	202.1698	190.9103	188.2622	194.9352	209.1412	227.0738	243.9278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	48.7165	(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)													
	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	-78.3799	(71)
Water heating gains (Table 5)													
	107.6336	105.7686	100.3948	89.1264	79.4547	74.3914	70.3002	76.5426	85.4088	95.3608	103.0152	105.7764	(72)
Total internal gains	488.8339	485.3562	466.9890	434.8277	401.9620	377.6183	363.3267	371.1817	393.0414	423.8864	454.7347	476.7762	(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					
East	9.4500	23.0580		0.6300		0.7000		0.7700		66.5924		(76)	
West	4.6200	23.0580		0.6300		0.7000		0.7700		32.5563		(80)	
Solar gains	99.1487	168.8462	276.9991	413.6162	489.7732	536.1743	507.5743	444.3164	345.3098	216.7397	119.4235	78.1385	(83)
Total gains	587.9825	654.2025	743.9881	848.4438	891.7352	913.7927	870.9011	815.4981	738.3512	640.6260	574.1582	554.9147	(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	56.3989	56.6030	56.6030	56.8936	56.7020	57.0765	57.0765	57.3344	57.2507	56.9862	57.0765	56.7020	
alpha	4.7599	4.7735	4.7735	4.7929	4.7801	4.8051	4.8051	4.8223	4.8167	4.7991	4.8051	4.7801	
util living area	0.9873	0.9780	0.9436	0.8421	0.6605	0.4055	0.2422	0.2870	0.5900	0.8850	0.9741	0.9899	(86)
Tweekday	18.7450	18.9034	19.2202	19.5322	19.6667	19.7018	19.7027	19.7077	19.6977	19.5244	19.0976	18.7124	
Tweekend	20.4805	20.5508	20.6973	20.8520	20.9361	20.9615	20.9634	20.9634	20.9516	20.8413	20.6344	20.4637	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.1982	20.3051	20.5329	20.7689	20.9014	20.9408	20.9435	20.9435	20.9245	20.7550	20.4291	20.1723	(87)
Th 2	19.7727	19.7765	19.7765	19.7820	19.7784	19.7854	19.7854	19.7901	19.7886	19.7837	19.7854	19.7784	(88)
util rest of house	0.9825	0.9699	0.9231	0.7912	0.5729	0.3002	0.1292	0.1675	0.4738	0.8331	0.9627	0.9860	(89)

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Tweekday	18.7450	18.9034	19.2202	19.5322	19.6667	19.7018	19.7027	19.7077	19.6977	19.5244	19.0976	18.7124
Tweekend	18.7450	18.9034	19.2202	19.5322	19.6667	19.7018	19.7027	19.7077	19.6977	19.5244	19.0976	18.7124
MIT 2	18.7450	18.9034	19.2202	19.5322	19.6667	19.7018	19.7027	19.7077	19.6977	19.5244	19.0976	18.7124 (90)
Living area fraction									fLA = Living area / (4) =			0.4539 (91)
MIT	19.4046	19.5397	19.8161	20.0935	20.2271	20.2642	20.2659	20.2686	20.2545	20.0830	19.7020	19.3750 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4046	19.5397	19.8161	20.0935	20.2271	20.2642	20.2659	20.2686	20.2545	20.0830	19.7020	19.3750 (93)

8. Space heating requirement

Utilisation	Jan 0.9807	Feb 0.9680	Mar 0.9239	Apr 0.8055	May 0.6065	Jun 0.3421	Jul 0.1740	Aug 0.2149	Sep 0.5201	Oct 0.8477	Nov 0.9617	Dec 0.9843 (94)
Useful gains	576.6122	633.2509	687.3479	683.4252	540.8484	312.5988	151.5025	175.2400	383.9893	543.0734	552.1614	546.2287 (95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)
Heat loss rate W	1167.4242	1133.3304	1000.3735	806.0455	566.2740	313.8134	151.5306	175.3231	393.0399	673.7323	942.2028	1158.7696 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	439.5641	336.0534	232.8911	88.2866	18.9166	0.0000	0.0000	0.0000	0.0000	97.2102	280.8298	455.7304 (98)
Space heating												1949.4823 (98)
Space heating per m2										(98) / (4) =		32.9193 (99)

8c. Space cooling requirement

Not applicable

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 %)												260.4065 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												748.6305 (211)
Space heating requirement	Jan 439.5641	Feb 336.0534	Mar 232.8911	Apr 88.2866	May 18.9166	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 97.2102	Nov 280.8298	Dec 455.7304 (98)
Space heating efficiency (main heating system 1)	260.4065	260.4065	260.4065	260.4065	260.4065	0.0000	0.0000	0.0000	0.0000	260.4065	260.4065	260.4065 (210)
Space heating fuel (main heating system)	168.7992	129.0496	89.4337	33.9034	7.2643	0.0000	0.0000	0.0000	0.0000	37.3302	107.8429	175.0073 (211)
Water heating 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 (215)
Water heating requirement	151.5563	119.0534	99.6842	53.7904	27.8825	7.5035	4.3618	29.0104	56.3130	100.1979	132.1148	152.4573 (64)
Efficiency of water heater (217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	55.8393	43.8640	36.7276	19.8185	10.2730	2.7646	1.6071	10.6886	20.7479	36.9169	48.6763	56.1713 (219)
Water heating fuel used												344.0950 (219)
Annual totals kWh/year												
Space heating fuel - main system												748.6305 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												269.1890 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1143 * 0.80) =									-1828.1879			-1828.1879 (233)
Total delivered energy for all uses												-416.2733 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	748.6305	19.4400	145.5338 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	344.0950	19.4400	66.8921 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	19.4400	9.7200 (249)
Energy for lighting	269.1890	19.4400	52.3303 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1828.1879	19.4400	-355.3997 (252)
Total energy cost			-80.9235 (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	748.6305	0.5190	388.5392 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	344.0950	0.5190	178.5853 (264)
Space and water heating			567.1246 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	269.1890	0.5190	139.7091 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	0.5190	-948.8295 (269)
Total kg/year			-216.0459 (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	748.6305	3.0700	2298.2957 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	344.0950	3.0700	1056.3718 (264)
Space and water heating			3354.6675 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	269.1890	3.0700	826.4102 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	3.0700	-5612.5368 (269)
Primary energy kWh/year			-1277.9591 (272)
Primary energy kWh/m2/year			-21.5799 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	281.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	486.21 (P1)
Transmission heat loss coefficient	48.54 (37)
Summer heat loss coefficient	534.74 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.4500	117.5071	0.6300	0.7000	0.9000	396.6609
West	4.6200	117.5071	0.6300	0.7000	0.9000	193.9231
total:						590.5840

	Jun	Jul	Aug	
Solar gains	627	591	520	(P3)
Internal gains	392	377	384	
Total summer gains	1019	968	904	(P5)
Summer gain/loss ratio	1.90	1.81	1.69	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 281.8)	0.03	0.03	0.03	
Threshold temperature	17.93	19.74	19.52	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019664	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 3, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.98
Environmental	88 B	TER	31.73
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.34
General Requirements Compliance	Pass	DFEE	56.95
		TFEE	62.39
		% DFEE<TFEE	8.72
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.73	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.98	kgCO ₂ /m ²	Pass
	-13.75 (-43.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.39	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	56.95	kWh/m ² /yr	
	-5.5 (-8.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.09 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Samsung Electronics AE050RXYDEG	
Secondary heating system	None	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.32 kWh/day
Permitted by DBSCG 2.03

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing East

9.45 m², No overhang

Windows facing West

4.62 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Window U-value

1.00 W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019664	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 3, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	17.98
Environmental	88 B	TER	31.73
CO ₂ Emissions (t/year)	0.87	% DER<TER	43.34
General Requirements Compliance	Pass	DFEE	56.95
		TFEE	62.39
		% DFEE<TFEE	8.72
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	House, Mid-Terrace					
2.0 Number of Storeys	2					
3.0 Date Built	2022					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
	Ground Floor:		7.90 m	26.88 m ²	2.40 m	
	1st Storey:		8.40 m	32.34 m ²	3.70 m	
7.0 Living Area	26.88			m ²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	281.78			kJ/m ² K		
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)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.20	60.00	50.40 32.32
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	71.96
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame				9.00	22.08
Internal Wall 2	Plasterboard on timber frame				9.00	4.32
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)
Slope	External Slope Roof	Plasterboard, insulated slope		0.14	9.00	44.66 44.66

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	26.88

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	26.88
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.14	20.00	5.46

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	26.88

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Main Wall	West							1.91	
Front Windows	Window	[1] Main Wall	West	None	0.00					4.62	
Rear Door	Solid Door	[1] Main Wall	East							2.10	
Rear Windows	Window	[1] Main Wall	East	None	0.00					9.45	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	9.90	0.300	No
Table K1 - Approved	E3 Sill	6.30	0.040	No
Table K1 - Approved	E4 Jamb	30.30	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	7.90	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	8.40	0.070	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	11.60	0.040	No
Table K1 - Approved	E18 Party wall between dwellings	20.00	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	12.80	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	15.40	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	15.40	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	7.70	0.080	No

Y-value

0.095

W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	8	
Total number of L.E.L. fittings	8	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Percentage of Heat	100	%
Database Ref. No.	104361	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
	No

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

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
SAP Code	901
Immersion Only Heating Hot Water	Yes

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	170.00	L
Loss	1.32	kWh/day
Pipes insulation	Fully insulated primary pipework	

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

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
Solar water heating	£4,000 - £6,000	£52	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£355	A 101	

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000632	Issued on Date	13/06/2022
Block Name	Uxbridge Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
019662-001	1	59.22	18.70	34.49	45.79 %
019663-001	1	59.22	17.99	31.76	43.36 %
019664-001	1	59.22	17.98	31.73	43.34 %
019665-001	1	68.04	16.55	31.96	48.21 %
Totals:	4	245.7	71.22	129.94	
Average DER = 17.76 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 32.47 kgCO ₂ /m ²		45.30 %			

Block Compliance Report - DFEE

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
019662-001	1	59.22	65.79	71.59	8.11 %
019663-001	1	59.22	57.00	62.48	8.77 %
019664-001	1	59.22	56.95	62.39	8.72 %
019665-001	1	68.04	59.37	66.50	10.71 %
Totals:	4	245.7	239.10	262.95	
Average DFEE = 59.76 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 65.76 kWh/m ² /yr		9.12 %			

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 4, 1178 -1184, Uxbridge Road
HAYES, UB4 8JB

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 13/06/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

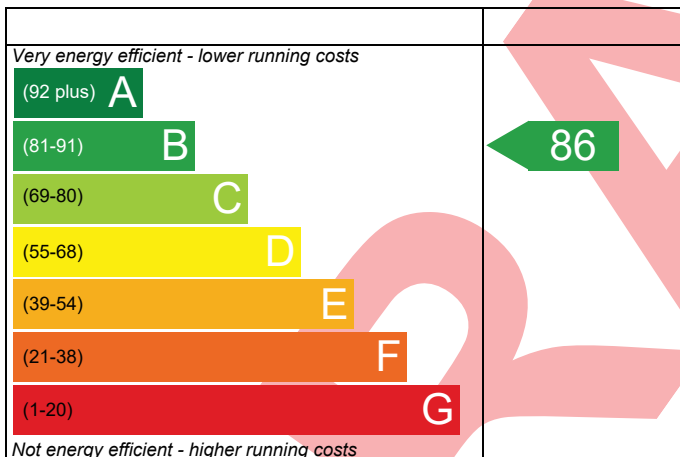
Plot 4, 1178 -1184, Uxbridge Road,
HAYES,
UB4 8JB

Dwelling type: House, End-Terrace
Date of assessment: 13/06/2022
Produced by: Energy Calculations Limited
Total floor area: 68.04 m²

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 SAP2012 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

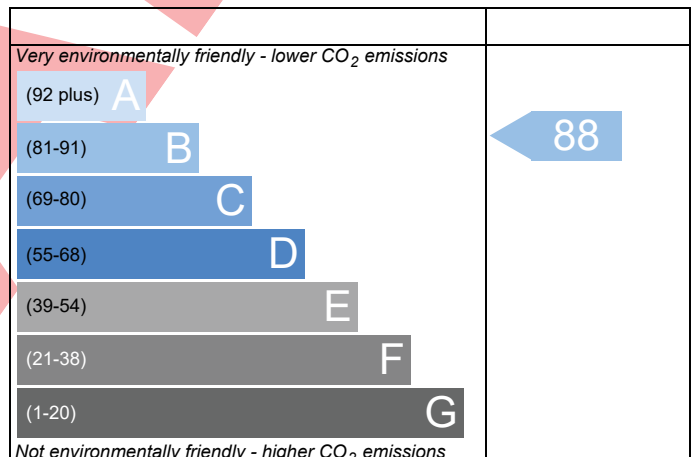


England

EU Directive
2002/91/EC

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



England

EU Directive
2002/91/EC

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.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

THERMAL BRIDGING

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019665	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 4, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	16.55
Environmental	88 B	TER	31.96
CO ₂ Emissions (t/year)	0.94	% DER<TER	48.21
General Requirements Compliance	Pass	DFEE	59.37
		TFEE	66.50
		% DFEE<TFEE	10.71
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	9.90	2.97	
External wall	E3 Sill	Table K1 - Approved	0.040	6.30	0.25	
External wall	E4 Jamb	Table K1 - Approved	0.050	30.30	1.52	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	17.60	2.82	
External wall	E6 Intermediate floor within a dwelling	Table K1 - Approved	0.070	16.60	1.16	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	11.60	0.46	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	12.40	1.12	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	2.40	-0.22	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	7.60	0.46	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	6.90	1.10	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	7.70	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Table K1 - Default	0.080	7.70	0.62	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	7.70	0.62	

Total: **12.87** W/mK:
Y-Value: **0.073** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Property Reference	019665			Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref			
Property	Plot 4, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB				
SAP Rating	86 B	DER	16.55	TER	31.96
Environmental	88 B	% DER<TER	48.21		
CO ₂ Emissions (t/year)	0.94	DFEE	59.37	TFEE	66.50
General Requirements Compliance	Pass	% DFEE<TFEE	10.71		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

End-Terrace House, total floor area 68 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 31.96 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)66.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)59.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.07 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Samsung Electronics AE050RXYDEG

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.32 kWh/day	
Permitted by DBSCG 2.03	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing East:	9.45 m ² , No overhang
Windows facing South:	2.53 m ² , No overhang
Windows facing West:	5.49 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Window U-value	1.00 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	40.1810	39.9585	39.7404	38.7161	38.5244	37.6323	37.6323	37.4671	37.9759	38.5244	38.9121	39.3175 (38)
Heat transfer coeff	101.3157	101.0932	100.8751	99.8508	99.6591	98.7670	98.7670	98.6017	99.1106	99.6591	100.0468	100.4521 (39)
Average = Sum(39)m / 12 =												99.8498 (39)
HLP	1.4891	1.4858	1.4826	1.4675	1.4647	1.4516	1.4516	1.4492	1.4567	1.4647	1.4704	1.4764 (40)
HLP (average)												1.4675 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)												
If cylinder contains dedicated solar storage												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (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)												
Total heat required for water heating calculated for each month												
186.2900 164.2285 172.5514 154.7852 151.7601 135.7118 130.4401 142.9908 142.6936 160.4983 169.5793 181.8431 (62)												
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 (63)												
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
186.2900 164.2285 172.5514 154.7852 151.7601 135.7118 130.4401 142.9908 142.6936 160.4983 169.5793 181.8431 (64)												
Total per year (kWh/year) = Sum(64)m =												1893.3721 (64)
Heat gains from water heating, kWh/month												
83.1468 73.7593 78.5788 71.9875 71.6656 65.6456 64.5768 68.7499 67.9670 74.5711 76.9065 81.6683 (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	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1776	15.2570	12.4078	9.3935	7.0217	5.9281	6.4055	8.3261	11.1752	14.1895	16.5613	17.6550 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	192.6800	194.6794	189.6409	178.9147	165.3746	152.6489	144.1474	142.1480	147.1864	157.9127	171.4527	184.1784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881 (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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	111.7565	109.7608	105.6166	99.9826	96.3248	91.1744	86.7967	92.4057	94.3986	100.2300	106.8146	109.7692 (72)
Total internal gains	377.5783	375.6614	363.6296	344.2550	324.6854	305.7156	293.3138	298.8440	308.7245	328.2965	350.7928	367.5668 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.4500	19.6403	0.6300	0.7000	0.7700		56.7219 (76)	
South					2.5300	46.7521	0.6300	0.7000	0.7700		36.1487 (78)	
West					5.4900	19.6403	0.6300	0.7000	0.7700		32.9527 (80)	
Solar gains	125.8234	234.6250	364.3094	506.5711	605.1837	614.0674	586.7558	513.3810	414.7762	272.0090	154.6623	104.9799 (83)
Total gains	503.4017	610.2864	727.9390	850.8261	929.8691	919.7830	880.0696	812.2250	723.5007	600.3055	505.4552	472.5467 (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	41.0064	41.0967	41.1855	41.6080	41.6881	42.0646	42.0646	42.1351	41.9188	41.6881	41.5265	41.3589
alpha	3.7338	3.7398	3.7457	3.7739	3.7792	3.8043	3.8043	3.8090	3.7946	3.7792	3.7684	3.7573
util living area	0.9924	0.9839	0.9618	0.9031	0.7895	0.6254	0.4761	0.5299	0.7686	0.9423	0.9858	0.9940 (86)
Tweekday	17.9242	18.1816	18.5893	19.0764	19.4158	19.5807	19.6140	19.6120	19.5109	19.0460	18.3988	17.8875
Tweekend	20.1274	20.2415	20.4246	20.6479	20.8197	20.9144	20.9432	20.9380	20.8649	20.6262	20.3335	20.1080
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.6533	19.8267	20.1120	20.4501	20.7217	20.8686	20.9124	20.9042	20.7891	20.4232	19.9592	19.6234 (87)
Th 2	19.6957	19.6982	19.7006	19.7119	19.7141	19.7240	19.7240	19.7258	19.7202	19.7141	19.7098	19.7053 (88)
util rest of house	0.9900	0.9790	0.9499	0.8730	0.7269	0.5232	0.3463	0.3960	0.6780	0.9177	0.9807	0.9921 (89)
Tweekday	17.9242	18.1816	18.5893	19.0764	19.4158	19.5807	19.6140	19.6120	19.5109	19.0460	18.3988	17.8875
Tweekend	17.9242	18.1816	18.5893	19.0764	19.4158	19.5807	19.6140	19.6120	19.5109	19.0460	18.3988	17.8875
MIT 2	17.9242	18.1816	18.5893	19.0764	19.4158	19.5807	19.6140	19.6120	19.5109	19.0460	18.3988	17.8875 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	18.7638	18.9805	19.3287	19.7435	20.0499	20.2061	20.2445	20.2395	20.1316	19.7147	19.1565	18.7304 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7638	18.9805	19.3287	19.7435	20.0499	20.2061	20.2445	20.2395	20.1316	19.7147	19.1565	18.7304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	497.2461	595.3319	688.4572	743.4772	692.5546	518.6740	352.7676	367.2574	513.8174	550.9350	494.2027	467.9090 (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												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1465.4146	1423.4385	1294.0979	1082.7303	832.1483	553.6942	359.9573	378.5833	597.7910	908.3670	1206.2158	1459.6137 (97)
Space heating	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	720.3173	556.4876	450.5966	244.2623	103.8578	0.0000	0.0000	0.0000	0.0000	265.9294	512.6494	737.8283 (98)
Space heating												3591.9288 (98)
Space heating per m2											(98) / (4) =	52.7914 (99)

8c. Space cooling requirement

Not applicable

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 %)												307.3153 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1168.8088 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	720.3173	556.4876	450.5966	244.2623	103.8578	0.0000	0.0000	0.0000	0.0000	265.9294	512.6494	737.8283 (98)
Space heating efficiency (main heating system 1)	307.3153	307.3153	307.3153	307.3153	307.3153	0.0000	0.0000	0.0000	0.0000	307.3153	307.3153	307.3153 (210)
Space heating fuel (main heating system)	234.3903	181.0803	146.6235	79.4826	33.7952	0.0000	0.0000	0.0000	0.0000	86.5331	166.8154	240.0883 (211)
Water heating 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 (215)
Water heating requirement	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	68.6366	60.5083	63.5747	57.0290	55.9144	50.0016	48.0593	52.6834	52.5739	59.1339	62.4797	66.9982 (219)
Water heating fuel used												697.5930 (219)
Annual totals kWh/year												
Space heating fuel - main system												1168.8088 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												303.3611 (232)
Electricity for lighting (calculated in Appendix L)												2169.7629 (238)
Total delivered energy for all uses												

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	1168.8088	0.5190	606.6118 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	697.5930	0.5190	362.0508 (264)
Space and water heating			968.6625 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	303.3611	0.5190	157.4444 (268)
Total CO2, kg/year			1126.1070 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5500 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.5500 ZC1
Total Floor Area	TFA	68.0400
Assumed number of occupants	N	2.1976
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7810 ZC2
CO2 emissions from cooking, equation (L16)		2.5241 ZC3
Total CO2 emissions		35.8552 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.8552 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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 Opaque door			4.0100	1.0000	4.0100		(26)					
TER Opening Type (Uw = 1.40)			13.0000	1.3258	17.2348		(27)					
Main Floor			33.0400	0.1300	4.2952		(28a)					
Main Wall	93.8000	17.0100	76.7900	0.1800	13.8222		(29a)					
Slope	48.3000		48.3000	0.1300	6.2790		(30)					
Total net area of external elements Aum(A, m2)			175.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.6412		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2090 (36)					
Total fabric heat loss						(33) + (36) =	54.8502 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1810	Feb 39.9585	Mar 39.7404	Apr 38.7161	May 38.5244	Jun 37.6323	Jul 37.6323	Aug 37.4671	Sep 37.9759	Oct 38.5244	Nov 38.9121	Dec 39.3175 (38)
Heat transfer coeff	95.0312	94.8087	94.5907	93.5663	93.3747	92.4825	92.4825	92.3173	92.8262	93.3747	93.7624	94.1677 (39)
Average = Sum(39)m / 12 =												93.5654 (39)
HLP	Jan 1.3967	Feb 1.3934	Mar 1.3902	Apr 1.3752	May 1.3723	Jun 1.3592	Jul 1.3592	Aug 1.3568	Sep 1.3643	Oct 1.3723	Nov 1.3780	Dec 1.3840 (40)
HLP (average)												1.3752 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)											Total = Sum(45)m =	1359.3041 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5003 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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)
Total heat required for water heating calculated for each month	189.3085	166.9549	175.5699	157.7064	154.7786	138.6330	133.4586	146.0093	145.6147	163.5168	172.5004	184.8616 (62)
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 (63)
Output from w/h	189.3085	166.9549	175.5699	157.7064	154.7786	138.6330	133.4586	146.0093	145.6147	163.5168	172.5004	184.8616 (64)
Heat gains from water heating, kWh/month	85.5616	75.9404	80.9936	74.3244	74.0804	67.9825	66.9916	71.1647	70.3039	76.9859	79.2434	84.0831 (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	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3922	15.4476	12.5629	9.5109	7.1095	6.0021	6.4855	8.4301	11.3149	14.3669	16.7683	17.8756 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	192.6800	194.6794	189.6409	178.9147	165.3746	152.6489	144.1474	142.1480	147.1864	157.9127	171.4527	184.1784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	115.0022	113.0065	108.8623	103.2283	99.5705	94.4201	90.0424	95.6514	97.6443	103.4757	110.0603	113.0149 (72)
Total internal gains	384.0387	382.0978	370.0304	350.6181	331.0189	312.0354	299.6396	305.1938	315.1099	334.7195	357.2455	374.0332 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				7.0300	19.6403		0.6300	0.7000		0.7700	42.1963 (76)	
South				1.8800	46.7521		0.6300	0.7000		0.7700	26.8615 (78)	
West				4.0900	19.6403		0.6300	0.7000		0.7700	24.5495 (80)	

Solar gains	93.6073	174.5612	271.0668	376.9416	450.3356	456.9519	436.6260	382.0154	308.6256	202.3808	115.0642	78.0993 (83)
Total gains	477.6460	556.6590	641.0971	727.5597	781.3545	768.9873	736.2656	687.2091	623.7355	537.1003	472.3097	452.1325 (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	49.7205	49.8372	49.9521	50.4989	50.6026	51.0907	51.0907	51.1822	50.9016	50.6026	50.3933	50.1764
alpha	4.3147	4.3225	4.3301	4.3666	4.3735	4.4060	4.4060	4.4121	4.3934	4.3735	4.3596	4.3451
util living area	0.9961	0.9918	0.9799	0.9428	0.8542	0.6958	0.5338	0.5875	0.8252	0.9650	0.9923	0.9969 (86)
MIT	19.5321	19.7123	20.0169	20.4084	20.7334	20.9244	20.9815	20.9721	20.8329	20.3994	19.8939	19.5023 (87)
Th 2	19.7659	19.7684	19.7708	19.7824	19.7846	19.7947	19.7947	19.7966	19.7908	19.7846	19.7802	19.7756 (88)
util rest of house	0.9947	0.9890	0.9726	0.9212	0.7996	0.5927	0.3970	0.4484	0.7414	0.9475	0.9892	0.9958 (89)
MIT 2	17.8415	18.1053	18.5471	19.1067	19.5318	19.7468	19.7885	19.7860	19.6627	19.1070	18.3793	17.8047 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	18.6625	18.8856	19.2609	19.7388	20.1153	20.3186	20.3678	20.3620	20.2309	19.7346	19.1148	18.6290 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6625	18.8856	19.2609	19.7388	20.1153	20.3186	20.3678	20.3620	20.2309	19.7346	19.1148	18.6290 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9930	0.9862	0.9686	0.9203	0.8162	0.6402	0.4639	0.5163	0.7755	0.9466	0.9867	0.9944 (94)
Useful gains	474.2868	549.0006	620.9970	669.5859	637.7338	492.3033	341.5402	354.8135	483.6772	508.3989	466.0503	449.5953 (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	1364.8825	1325.9602	1207.0583	1014.1454	785.7746	528.8748	348.4578	365.7611	569.1126	852.9390	1126.5352	1358.7493 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	662.6032	522.1168	436.0296	248.0828	110.1424	0.0000	0.0000	0.0000	0.0000	256.3378	475.5491	676.4106 (98)
Space heating												3387.2724 (98)
Space heating per m2											(98) / (4) =	49.7835 (99)

8c. Space cooling requirement

Not applicable

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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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3622.7512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	662.6032	522.1168	436.0296	248.0828	110.1424	0.0000	0.0000	0.0000	0.0000	256.3378	475.5491	676.4106	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	708.6665	558.4137	466.3418	265.3292	117.7994	0.0000	0.0000	0.0000	0.0000	274.1581	508.6087	723.4338	(211)
Water heating 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	(215)
Water heating requirement	189.3085	166.9549	175.5699	157.7064	154.7786	138.6330	133.4586	146.0093	145.6147	163.5168	172.5004	184.8616	(64)
Efficiency of water heater (217)m	87.8815	87.6524	87.1456	86.0175	83.9254	79.8000	79.8000	79.8000	79.8000	86.0086	87.3812	79.8000	(216)
Fuel for water heating, kWh/month	215.4133	190.4739	201.4672	183.3421	184.4240	173.7255	167.2413	182.9690	182.4746	190.1169	197.4113	210.1457	(219)
Water heating fuel used												2279.2048	(219)
Annual totals kWh/year													
Space heating fuel - main system												3622.7512	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												307.1525	(232)
Total delivered energy for all uses												6284.1085	(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	3622.7512	0.2160	782.5143 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.2048	0.2160	492.3082 (264)
Space and water heating			1274.8225 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	307.1525	0.5190	159.4121 (268)
Total CO2, kg/m2/year			1473.1596 (272)
Emissions per m2 for space and water heating			18.7364 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3429 (272b)
Emissions per m2 for pumps and fans			0.5721 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.7364 * 1.55) + 2.3429 + 0.5721, rounded to 2 d.p.			31.9600 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			9.0000	297.3600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14659.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 215.4494 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	40.1810	39.9585	39.7404	38.7161	38.5244	37.6323	37.6323	37.4671	37.9759	38.5244	38.9121	39.3175 (38)
Heat transfer coeff	101.3157	101.0932	100.8751	99.8508	99.6591	98.7670	98.7670	98.6017	99.1106	99.6591	100.0468	100.4521 (39)
Average = Sum(39)m / 12 =												99.8498 (39)
HLP	1.4891	1.4858	1.4826	1.4675	1.4647	1.4516	1.4516	1.4492	1.4567	1.4647	1.4704	1.4764 (40)
HLP (average)												1.4675 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

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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)
Heat gains from water heating, kWh/month	29.9478	26.1925	27.0283	23.5640	22.6102	19.5109	18.0797	20.7467	20.9945	24.4671	26.7077	29.0028 (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	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1776	15.2570	12.4078	9.3935	7.0217	5.9281	6.4055	8.3261	11.1752	14.1895	16.5613	17.6550	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	192.6800	194.6794	189.6409	178.9147	165.3746	152.6489	144.1474	142.1480	147.1864	157.9127	171.4527	184.1784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	(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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	(71)
Water heating gains (Table 5)	40.2524	38.9770	36.3284	32.7277	30.3900	27.0984	24.3007	27.8854	29.1590	32.8858	37.0940	38.9823	(72)
Total internal gains	306.0742	304.8776	294.3414	277.0001	258.7506	241.6397	230.8177	234.3236	243.4849	260.9523	281.0723	296.7799	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East					9.4500	19.6403	0.6300	0.7000			0.7700			56.7219 (76)
South					2.5300	46.7521	0.6300	0.7000			0.7700			36.1487 (78)
West					5.4900	19.6403	0.6300	0.7000			0.7700			32.9527 (80)
Solar gains	125.8234	234.6250	364.3094	506.5711	605.1837	614.0674	586.7558	513.3810	414.7762	272.0090	154.6623	104.9799	(83)	
Total gains	431.8976	539.5025	658.6508	783.5712	863.9343	855.7070	817.5735	747.7047	658.2611	532.9613	435.7346	401.7599	(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	40.1912	40.2796	40.3667	40.7808	40.8592	41.2283	41.2283	41.2974	41.0854	40.8592	40.7009	40.5367	
alpha	3.6794	3.6853	3.6911	3.7187	3.7239	3.7486	3.7486	3.7532	3.7390	3.7239	3.7134	3.7024	
util living area	0.9951	0.9885	0.9704	0.9193	0.8151	0.6574	0.5070	0.5663	0.8038	0.9573	0.9907	0.9962	(86)
MIT	19.1709	19.4132	19.8051	20.2901	20.6758	20.8984	20.9707	20.9560	20.7743	20.2339	19.6054	19.1299	(87)
Th 2	19.6957	19.6982	19.7006	19.7119	19.7141	19.7240	19.7240	19.7258	19.7202	19.7141	19.7098	19.7053	(88)
util rest of house	0.9936	0.9850	0.9610	0.8932	0.7563	0.5546	0.3712	0.4272	0.7187	0.9383	0.9873	0.9951	(89)
MIT 2	18.0572	18.2995	18.6869	19.1594	19.5026	19.6781	19.7167	19.7134	19.5978	19.1197	18.5007	18.0234	(90)
Living area fraction	18.5980	18.8403	19.2299	19.7085	20.0723	20.2707	20.3256	20.3168	20.1691	19.6607	19.0371	18.5607	(91)
Temperature adjustment												0.0000	
adjusted MIT	18.5980	18.8403	19.2299	19.7085	20.0723	20.2707	20.3256	20.3168	20.1691	19.6607	19.0371	18.5607	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9918	0.9819	0.9567	0.8931	0.7744	0.6012	0.4374	0.4946	0.7521	0.9373	0.9848	0.9936	(94)
Ext temp.	428.3548	529.7192	630.1153	699.8091	669.0133	514.4776	357.5859	369.8510	495.0482	499.5360	429.1301	399.2026	(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)
Month fracti	1448.6110	1409.2691	1284.1268	1079.2352	834.3767	560.0745	367.9695	386.2031	601.5139	902.9852	1194.2701	1442.5676	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	759.0706	591.0575	486.5845	273.1868	123.0303	0.0000	0.0000	0.0000	0.0000	300.1662	550.9008	776.2636	(98)
												3860.2604	(98)
												56.7352	(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	928.4093	730.8754	749.3732	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8452	0.9015	0.8734	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	784.6583	658.8770	654.5041	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1081.8295	1035.6138	955.2531	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	213.9633	280.2922	223.7572	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												718.0127 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	53.4908	70.0730	55.9393	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												179.5032 (107)
Space cooling per m2												2.6382 (108)
Energy for space heating												56.7352 (99)
Energy for space cooling												2.6382 (108)
Total												59.3734 (109)
Dwelling Fabric Energy Efficiency (DFEE)												59.4 (109)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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 Opaque door			4.0100	1.0000	4.0100		(26)
TER Opening Type (Uw = 1.40)			13.0000	1.3258	17.2348		(27)
Main Floor			33.0400	0.1300	4.2952		(28a)
Main Wall	93.8000	17.0100	76.7900	0.1800	13.8222		(29a)
Slope	48.3000		48.3000	0.1300	6.2790		(30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.6412		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.2090 (36)
Total fabric heat loss						(33) + (36) =	54.8502 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.1810	39.9585	39.7404	38.7161	38.5244	37.6323	37.6323	37.4671	37.9759	38.5244	38.9121	39.3175 (38)
Heat transfer coeff	95.0312	94.8087	94.5907	93.5663	93.3747	92.4825	92.4825	92.3173	92.8262	93.3747	93.7624	94.1677 (39)
Average = Sum(39)m / 12 =												93.5654 (39)
HLP	1.3967	1.3934	1.3902	1.3752	1.3723	1.3592	1.3592	1.3568	1.3643	1.3723	1.3780	1.3840 (40)
HLP (average)												1.3752 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (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												

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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)
Heat gains from 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 (59)
	29.9478	26.1925	27.0283	23.5640	22.6102	19.5109	18.0797	20.7467	20.9945	24.4671	26.7077	29.0028 (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	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808	109.8808 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3922	15.4476	12.5629	9.5109	7.1095	6.0021	6.4855	8.4301	11.3149	14.3669	16.7683	17.8756 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	192.6800	194.6794	189.6409	178.9147	165.3746	152.6489	144.1474	142.1480	147.1864	157.9127	171.4527	184.1784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881	33.9881 (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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	40.2524	38.9770	36.3284	32.7277	30.3900	27.0984	24.3007	27.8854	29.1590	32.8858	37.0940	38.9823 (72)
Total internal gains	306.2889	305.0682	294.4964	277.1175	258.8384	241.7137	230.8978	234.4277	243.6246	261.1296	281.2793	297.0006 (73)

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
East			7.0300		19.6403		0.6300		0.7000		0.7700	42.1963 (76)
South			1.8800		46.7521		0.6300		0.7000		0.7700	26.8615 (78)
West			4.0900		19.6403		0.6300		0.7000		0.7700	24.5495 (80)

Solar gains	93.6073	174.5612	271.0668	376.9416	450.3356	456.9519	436.6260	382.0154	308.6256	202.3808	115.0642	78.0993 (83)
Total gains	399.8962	479.6294	565.5632	654.0591	709.1740	698.6657	667.5238	616.4431	552.2502	463.5104	396.3435	375.0999 (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	49.7205	49.8372	49.9521	50.4989	50.6026	51.0907	51.0907	51.1822	50.9016	50.6026	50.3933	50.1764
alpha	4.3147	4.3225	4.3301	4.3666	4.3735	4.4060	4.4060	4.4121	4.3934	4.3735	4.3596	4.3451
util living area	0.9980	0.9954	0.9872	0.9594	0.8860	0.7419	0.5807	0.6411	0.8695	0.9790	0.9961	0.9985 (86)
MIT	19.4308	19.6135	19.9245	20.3309	20.6815	20.9022	20.9744	20.9608	20.7870	20.3137	19.7960	19.4015 (87)
Th 2	19.7659	19.7684	19.7708	19.7824	19.7846	19.7947	19.7947	19.7966	19.7908	19.7846	19.7802	19.7756 (88)
util rest of house	0.9973	0.9937	0.9823	0.9429	0.8384	0.6401	0.4357	0.4957	0.7961	0.9677	0.9944	0.9980 (89)
MIT 2	18.3513	18.5352	18.8455	19.2501	19.5719	19.7506	19.7886	19.7859	19.6731	19.2419	18.7269	18.3295 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	18.8755	19.0588	19.3695	19.7749	20.1107	20.3098	20.3644	20.3565	20.2140	19.7624	19.2461	18.8500 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8755	19.0588	19.3695	19.7749	20.1107	20.3098	20.3644	20.3565	20.2140	19.7624	19.2461	18.8500 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9925	0.9803	0.9428	0.8529	0.6869	0.5069	0.5670	0.8255	0.9674	0.9934	0.9975 (94)
Ext temp.	398.5577	476.0094	554.4228	616.6470	604.8556	479.8983	338.3921	349.5414	455.9034	448.3946	393.7407	374.1467 (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)
Month fracti	1385.1272	1342.3806	1217.3325	1017.5244	785.3507	528.0556	348.1427	365.2509	567.5397	855.5351	1138.8435	1379.5585 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	734.0077	582.2015	493.2048	288.6317	134.2884	0.0000	0.0000	0.0000	0.0000	302.9126	536.4740	748.0264 (98)
Space heating per m2												3819.7471 (98)
										(98) / (4) =		56.1397 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	869.3357	684.3707	701.6115	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8282	0.8949	0.8653	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.9460	612.4123	607.0898	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	898.3733	860.3375	801.9689	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	128.4676	184.4564	144.9901	0.0000	0.0000	0.0000	0.0000 (104)
												457.9141 (104)

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Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.1169	46.1141	36.2475	0.0000	0.0000	0.0000 (107)
Space cooling											114.4785 (107)
Space cooling per m2											1.6825 (108)
Energy for space heating											56.1397 (99)
Energy for space cooling											1.6825 (108)
Total											57.8222 (109)
Target Fabric Energy Efficiency (TFEE)											66.5 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3438	0.3278	0.3278	0.3039	0.3199	0.2879	0.2879	0.2639	0.2719	0.2959	0.2879	0.3199 (22b)
Effective ac	0.5591	0.5537	0.5537	0.5462	0.5512	0.5414	0.5414	0.5348	0.5370	0.5438	0.5414	0.5512 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	38.5244	38.1544	38.1544	37.6323	37.9759	37.3063	37.3063	36.8503	36.9979	37.4671	37.3063	37.9759 (38)
Heat transfer coeff	99.6591	99.2890	99.2890	98.7670	99.1106	98.4409	98.4409	97.9849	98.1325	98.6017	98.4409	99.1106 (39)
Average = Sum(39)m / 12 =												98.7723 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4647	1.4593	1.4593	1.4516	1.4567	1.4468	1.4468	1.4401	1.4423	1.4492	1.4468	1.4567 (40)
HLP (average)												1.4517 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1976 (42)
Average daily hot water use (litres/day) 86.3934 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)												
If cylinder contains dedicated solar storage												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (62)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)												
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Total per year (kWh/year) = Sum(64)m =												1893.3721 (64)
1893 (64)												
RHI water heating demand												
Heat gains from water heating, kWh/month	83.1468	73.7593	78.5788	71.9875	71.6656	65.6456	64.5768	68.7499	67.9670	74.5711	76.9065	81.6683 (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 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 131.8569 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
42.9439 38.1424 31.0195 23.4837 17.5544 14.8201 16.0137 20.8152 27.9381 35.4738 41.4032 44.1374 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
287.5821 290.5663 283.0462 267.0368 246.8278 227.8342 215.1453 212.1611 219.6812 235.6906 255.8996 274.8932 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 50.3833 (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)												
-87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 -87.9046 (71)												
Water heating gains (Table 5)												
111.7565 109.7608 105.6166 99.9826 96.3248 91.1744 86.7967 92.4057 94.3986 100.2300 106.8146 109.7692 (72)												
Total internal gains	536.6181	532.8051	514.0179	484.8387	455.0426	428.1644	412.2914	419.7177	436.3536	465.7301	498.4530	523.1354 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	W/m2	Specific data or Table 6b	factor Table 6d	W
East		9.4500	23.0580	0.6300	0.7000	0.7700	66.5924 (76)
South		2.5300	52.5273	0.6300	0.7000	0.7700	40.6141 (78)
West		5.4900	23.0580	0.6300	0.7000	0.7700	38.6870 (80)

Solar gains	145.8935	237.0509	367.4430	524.5976	606.8598	659.1205	625.9980	557.1999	448.9038	297.5083	173.2725	116.6350 (83)
Total gains	682.5116	769.8560	881.4609	1009.4364	1061.9024	1087.2849	1038.2893	976.9176	885.2574	763.2383	671.7255	639.7704 (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 41.6881 41.8434 41.8434 42.0646 41.9188 42.2039 42.2039 42.4003 42.3366 42.1351 42.2039 41.9188												
alpha 3.7792 3.7896 3.7896 3.8043 3.7946 3.8136 3.8136 3.8267 3.8224 3.8090 3.8136 3.7946												
util living area 0.9755 0.9610 0.9176 0.8131 0.6460 0.4077 0.2456 0.2890 0.5785 0.8544 0.9564 0.9799 (86)												
Tweekday 18.3709 18.5711 18.9584 19.3506 19.5528 19.6201 19.6238 19.6291 19.6057 19.3533 18.8135 18.3275												
Tweekend 20.3215 20.4111 20.5906 20.7826 20.9002 20.9476 20.9535 20.9531 20.9281 20.7762 20.5162 20.2996												
24 / 16 0 0 0 0 0 0 0 0 0 0 0												
24 / 9 0 0 0 0 0 0 0 0 0 0 0												
16 / 9 0 0 0 0 0 0 0 0 0 0 0												
MIT 19.9528 20.0891 20.3682 20.6605 20.8460 20.9194 20.9283 20.9276 20.8878 20.6545 20.2445 19.9191 (87)												
Th 2 19.7141 19.7182 19.7182 19.7240 19.7202 19.7276 19.7276 19.7327 19.7311 19.7258 19.7276 19.7202 (88)												
util rest of house 0.9682 0.9497 0.8938 0.7630 0.5616 0.2991 0.1258 0.1636 0.4645 0.8013 0.9414 0.9738 (89)												
Tweekday 18.3709 18.5711 18.9584 19.3506 19.5528 19.6201 19.6238 19.6291 19.6057 19.3533 18.8135 18.3275												
Tweekend 18.3709 18.5711 18.9584 19.3506 19.5528 19.6201 19.6238 19.6291 19.6057 19.3533 18.8135 18.3275												
MIT 2 18.3709 18.5711 18.9584 19.3506 19.5528 19.6201 19.6238 19.6291 19.6057 19.3533 18.8135 18.3275 (90)												
Living area fraction fLA = Living area / (4) =												0.4856 (91)
MIT 19.1391 19.3082 19.6430 19.9867 20.1808 20.2510 20.2572 20.2596 20.2283 19.9852 19.5084 19.1004 (92)												
Temperature adjustment 0.0000												
adjusted MIT 19.1391 19.3082 19.6430 19.9867 20.1808 20.2510 20.2572 20.2596 20.2283 19.9852 19.5084 19.1004 (93)												

8. Space heating requirement

Utilisation	0.9641	0.9453	0.8922	0.7743	0.5936	0.3446	0.1759	0.2161	0.5112	0.8136	0.9382	0.9701 (94)
Useful gains	658.0244	727.7123	786.4610	781.6556	630.3238	374.6316	182.6279	211.1345	452.5758	620.9504	630.2036	620.6306 (95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)

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Heat loss rate W	1389.1543	1351.1484	1195.7352	966.6020	681.9570	379.1008	182.8281	211.6105	473.8105	807.0725	1123.0554	1377.6737 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	543.9606	418.9490	304.5000	133.1614	38.4151	0.0000	0.0000	0.0000	0.0000	138.4749	354.8533	563.2401 (98)
Space heating												2495.5544 (98)
RHI space heating demand												2496 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	40.1810	39.9585	39.7404	38.7161	38.5244	37.6323	37.6323	37.4671	37.9759	38.5244	38.9121	39.3175 (38)
Heat transfer coeff	101.3157	101.0932	100.8751	99.8508	99.6591	98.7670	98.7670	98.6017	99.1106	99.6591	100.0468	100.4521 (39)
Average = Sum(39)m / 12 =												99.8498 (39)
HLP	1.4891	1.4858	1.4826	1.4675	1.4647	1.4516	1.4516	1.4492	1.4567	1.4647	1.4704	1.4764 (40)
HLP (average)												1.4675 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

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Distribution loss (46)m = 0.15 x (45)m	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)												
If cylinder contains dedicated solar storage												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (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)
Total heat required for water heating calculated for each month												
186.2900 164.2285 172.5514 154.7852 151.7601 135.7118 130.4401 142.9908 142.6936 160.4983 169.5793 181.8431 (62)												
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 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Total per year (kWh/year) = Sum(64)m =												1893.3721 (64)
Heat gains from water heating, kWh/month												
83.1468 73.7593 78.5788 71.9875 71.6656 65.6456 64.5768 68.7499 67.9670 74.5711 76.9065 81.6683 (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	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9439	38.1424	31.0195	23.4837	17.5544	14.8201	16.0137	20.8152	27.9381	35.4738	41.4032	44.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5821	290.5663	283.0462	267.0368	246.8278	227.8342	215.1453	212.1611	219.6812	235.6906	255.8996	274.8932 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833 (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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	111.7565	109.7608	105.6166	99.9826	96.3248	91.1744	86.7967	92.4057	94.3986	100.2300	106.8146	109.7692 (72)
Total internal gains	536.6181	532.8051	514.0179	484.8387	455.0426	428.1644	412.2914	419.7177	436.3536	465.7301	498.4530	523.1354 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					9.4500	19.6403	0.6300	0.7000	0.7700		56.7219 (76)	
South					2.5300	46.7521	0.6300	0.7000	0.7700		36.1487 (78)	
West					5.4900	19.6403	0.6300	0.7000	0.7700		32.9527 (80)	
Solar gains	125.8234	234.6250	364.3094	506.5711	605.1837	614.0674	586.7558	513.3810	414.7762	272.0090	154.6623	104.9799 (83)
Total gains	662.4415	767.4301	878.3273	991.4099	1060.2263	1042.2318	999.0472	933.0987	851.1298	737.7391	653.1154	628.1153 (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	41.0064	41.0967	41.1855	41.6080	41.6881	42.0646	42.0646	42.1351	41.9188	41.6881	41.5265	41.3589
alpha	3.7338	3.7398	3.7457	3.7739	3.7792	3.8043	3.8043	3.8090	3.7946	3.7792	3.7684	3.7573
util living area	0.9814	0.9673	0.9351	0.8608	0.7346	0.5673	0.4244	0.4696	0.6975	0.9007	0.9684	0.9845 (86)
Tweekday	18.1568	18.3980	18.7681	19.1914	19.4658	19.5928	19.6161	19.6156	19.5459	19.1825	18.6033	18.1184
Tweekend	20.2317	20.3398	20.5086	20.7070	20.8508	20.9256	20.9467	20.9434	20.8911	20.6950	20.4267	20.2113
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8142	19.9788	20.2417	20.5424	20.7698	20.8857	20.9178	20.9126	20.8300	20.5292	20.1048	19.7827 (87)
Th 2	19.6957	19.6982	19.7006	19.7119	19.7141	19.7240	19.7240	19.7258	19.7202	19.7141	19.7098	19.7053 (88)
util rest of house	0.9761	0.9581	0.9168	0.8228	0.6674	0.4691	0.3064	0.3472	0.6024	0.8642	0.9578	0.9801 (89)
Tweekday	18.1568	18.3980	18.7681	19.1914	19.4658	19.5928	19.6161	19.6156	19.5459	19.1825	18.6033	18.1184
Tweekend	18.1568	18.3980	18.7681	19.1914	19.4658	19.5928	19.6161	19.6156	19.5459	19.1825	18.6033	18.1184
MIT 2	18.1568	18.3980	18.7681	19.1914	19.4658	19.5928	19.6161	19.6156	19.5459	19.1825	18.6033	18.1184 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	18.9616	19.1656	19.4836	19.8475	20.0990	20.2206	20.2482	20.2454	20.1694	19.8365	19.3324	18.9266 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9616	19.1656	19.4836	19.8475	20.0990	20.2206	20.2482	20.2454	20.1694	19.8365	19.3324	18.9266 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9722	0.9534	0.9132	0.8273	0.6890	0.5088	0.3559	0.3984	0.6383	0.8682	0.9539	0.9766 (94)
Ext temp.	644.0412	731.7061	802.1123	820.1710	730.4824	530.3063	355.5246	371.7794	543.2385	640.5219	623.0382	613.4034 (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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	1485.4533	1442.1567	1309.7253	1093.1115	837.0373	555.1320	360.3191	379.1655	601.5460	920.4990	1223.8157	1479.3157 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	626.0106	477.4228	377.6641	196.5171	79.2769	0.0000	0.0000	0.0000	0.0000	208.3029	432.5598	644.2388 (98)
Space heating												3041.9930 (98)
Space heating per m2											(98) / (4) =	44.7089 (99)

8c. Space cooling requirement

Not applicable

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 %)												307.3153 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												989.8604 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.0106	477.4228	377.6641	196.5171	79.2769	0.0000	0.0000	0.0000	0.0000	208.3029	432.5598	644.2388 (98)
Space heating efficiency (main heating system 1)	307.3153	307.3153	307.3153	307.3153	307.3153	0.0000	0.0000	0.0000	0.0000	307.3153	307.3153	307.3153 (210)
Space heating fuel (main heating system)	203.7030	155.3527	122.8914	63.9464	25.7966	0.0000	0.0000	0.0000	0.0000	67.7815	140.7544	209.6344 (211)
Water heating 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 (215)
Water heating requirement	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (217)
Fuel for water heating, kWh/month	68.6366	60.5083	63.5747	57.0290	55.9144	50.0016	48.0593	52.6834	52.5739	59.1339	62.4797	66.9982 (219)
Water heating fuel used												697.5930 (219)
Annual totals kWh/year												
Space heating fuel - main system												989.8604 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												303.3611 (232)
Electricity for lighting (calculated in Appendix L)												1990.8145 (238)
Total delivered energy for all uses												

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	989.8604	13.1900	130.5626 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	697.5930	13.1900	92.0125 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	303.3611	13.1900	40.0133 (250)
Additional standing charges			0.0000 (251)
Total energy cost			262.5884 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9756 (257)
SAP value		86.3897
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	989.8604	0.5190	513.7376 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	697.5930	0.5190	362.0508 (264)
Space and water heating			875.7883 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	303.3611	0.5190	157.4444 (268)
Total kg/year			1033.2327 (272)
CO2 emissions per m2			15.1900 (273)
EI value			87.7518
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.0732 = 4.603$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.0732 = 0.1811$, stars = 5
Water heating energy efficiency	$13.19 / 2.7142 = 4.860$, stars = 4
Water heating environmental impact	$0.519 / 2.7142 = 0.1912$, stars = 5

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3438	0.3278	0.3278	0.3039	0.3199	0.2879	0.2879	0.2639	0.2719	0.2959	0.2879	0.3199 (22b)
Effective ac	0.5591	0.5537	0.5537	0.5462	0.5512	0.5414	0.5414	0.5348	0.5370	0.5438	0.5414	0.5512 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	38.5244	38.1544	38.1544	37.6323	37.9759	37.3063	37.3063	36.8503	36.9979	37.4671	37.3063	37.9759 (38)
Heat transfer coeff	99.6591	99.2890	99.2890	98.7670	99.1106	98.4409	98.4409	97.9849	98.1325	98.6017	98.4409	99.1106 (39)
Average = Sum(39)m / 12 =												98.7723 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4647	1.4593	1.4593	1.4516	1.4567	1.4468	1.4468	1.4401	1.4423	1.4492	1.4468	1.4567 (40)
HLP (average)												1.4517 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1976 (42)
Average daily hot water use (litres/day) 86.3934 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

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Distribution loss (46)m = 0.15 x (45)m	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)												
If cylinder contains dedicated solar storage												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month												
186.2900 164.2285 172.5514 154.7852 151.7601 135.7118 130.4401 142.9908 142.6936 160.4983 169.5793 181.8431 (62)												
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 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Total per year (kWh/year) = Sum(64)m =												1893.3721 (64)
Heat gains from water heating, kWh/month												
83.1468 73.7593 78.5788 71.9875 71.6656 65.6456 64.5768 68.7499 67.9670 74.5711 76.9065 81.6683 (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	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9439	38.1424	31.0195	23.4837	17.5544	14.8201	16.0137	20.8152	27.9381	35.4738	41.4032	44.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5821	290.5663	283.0462	267.0368	246.8278	227.8342	215.1453	212.1611	219.6812	235.6906	255.8996	274.8932 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833 (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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	111.7565	109.7608	105.6166	99.9826	96.3248	91.1744	86.7967	92.4057	94.3986	100.2300	106.8146	109.7692 (72)
Total internal gains	536.6181	532.8051	514.0179	484.8387	455.0426	428.1644	412.2914	419.7177	436.3536	465.7301	498.4530	523.1354 (73)

6. Solar gains

[Jan]												
			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
East			9.4500	23.0580		0.6300		0.7000		0.7700	66.5924 (76)	
South			2.5300	52.5273		0.6300		0.7000		0.7700	40.6141 (78)	
West			5.4900	23.0580		0.6300		0.7000		0.7700	38.6870 (80)	
Solar gains	145.8935	237.0509	367.4430	524.5976	606.8598	659.1205	625.9980	557.1999	448.9038	297.5083	173.2725	116.6350 (83)
Total gains	682.5116	769.8560	881.4609	1009.4364	1061.9024	1087.2849	1038.2893	976.9176	885.2574	763.2383	671.7255	639.7704 (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	41.6881	41.8434	41.8434	42.0646	41.9188	42.2039	42.2039	42.4003	42.3366	42.1351	42.2039	41.9188
alpha	3.7792	3.7896	3.7896	3.8043	3.7946	3.8136	3.8136	3.8267	3.8224	3.8090	3.8136	3.7946
util living area	0.9755	0.9610	0.9176	0.8131	0.6460	0.4077	0.2456	0.2890	0.5785	0.8544	0.9564	0.9799 (86)
Tweekday	18.3709	18.5711	18.9584	19.3506	19.5528	19.6201	19.6238	19.6291	19.6057	19.3533	18.8135	18.3275
Tweekend	20.3215	20.4111	20.5906	20.7826	20.9002	20.9476	20.9535	20.9531	20.9281	20.7762	20.5162	20.2996
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.9528	20.0891	20.3682	20.6605	20.8460	20.9194	20.9283	20.9276	20.8878	20.6545	20.2445	19.9191 (87)
Th 2	19.7141	19.7182	19.7182	19.7240	19.7202	19.7276	19.7276	19.7327	19.7311	19.7258	19.7276	19.7202 (88)
util rest of house	0.9682	0.9497	0.8938	0.7630	0.5616	0.2991	0.1258	0.1636	0.4645	0.8013	0.9414	0.9738 (89)
Tweekday	18.3709	18.5711	18.9584	19.3506	19.5528	19.6201	19.6238	19.6291	19.6057	19.3533	18.8135	18.3275
Tweekend	18.3709	18.5711	18.9584	19.3506	19.5528	19.6201	19.6238	19.6291	19.6057	19.3533	18.8135	18.3275
MIT 2	18.3709	18.5711	18.9584	19.3506	19.5528	19.6201	19.6238	19.6291	19.6057	19.3533	18.8135	18.3275 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	19.1391	19.3082	19.6430	19.9867	20.1808	20.2510	20.2572	20.2596	20.2283	19.9852	19.5084	19.1004 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1391	19.3082	19.6430	19.9867	20.1808	20.2510	20.2572	20.2596	20.2283	19.9852	19.5084	19.1004 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	658.0244	727.7123	786.4610	781.6556	630.3238	374.6316	182.6279	211.1345	452.5758	620.9504	630.2036	620.6306 (95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000 (96)
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Month fraction	1389.1543	1351.1484	1195.7352	966.6020	681.9570	379.1008	182.8281	211.6105	473.8105	807.0725	1123.0554	1377.6737 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	543.9606	418.9490	304.5000	133.1614	38.4151	0.0000	0.0000	0.0000	0.0000	138.4749	354.8533	563.2401 (98)
Space heating requirement per m2												2495.5544 (98)
												36.6778 (99)

8c. Space cooling requirement

Not applicable

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 %)												304.6604 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												819.1267 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	543.9606	418.9490	304.5000	133.1614	38.4151	0.0000	0.0000	0.0000	0.0000	138.4749	354.8533	563.2401 (98)
Space heating efficiency (main heating system 1)	304.6604	304.6604	304.6604	304.6604	304.6604	0.0000	0.0000	0.0000	0.0000	304.6604	304.6604	304.6604 (210)
Space heating fuel (main heating system)	178.5466	137.5135	99.9474	43.7082	12.6091	0.0000	0.0000	0.0000	0.0000	45.4522	116.4750	184.8747 (211)
Water heating 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 (215)
Water heating requirement	186.2900	164.2285	172.5514	154.7852	151.7601	135.7118	130.4401	142.9908	142.6936	160.4983	169.5793	181.8431 (64)
Efficiency of water heater	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	68.6366	60.5083	63.5747	57.0290	55.9144	50.0016	48.0593	52.6834	52.5739	59.1339	62.4797	66.9982 (219)
Water heating fuel used												697.5930 (219)
Annual totals kWh/year												
Space heating fuel - main system												819.1267 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												303.3611 (232)
Electricity for lighting (calculated in Appendix L)												1820.0809 (238)
Total delivered energy for all uses												

10a. Fuel costs - using BEDF prices (495)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	819.1267	19.4400	159.2382 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	697.5930	19.4400	135.6121 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	303.3611	19.4400	58.9734 (250)
Additional standing charges			0.0000 (251)
Total energy cost			353.8237 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	819.1267	0.5190	425.1268 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	697.5930	0.5190	362.0508 (264)
Space and water heating			787.1776 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	303.3611	0.5190	157.4444 (268)
Total kg/year			944.6220 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	819.1267	3.0700	2514.7191 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	697.5930	3.0700	2141.6106 (264)
Space and water heating			4656.3296 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	303.3611	3.0700	931.3186 (268)
Primary energy kWh/year			5587.6482 (272)
Primary energy kWh/m2/year			82.1230 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 54	-145 kg (15.4%)
U Solar photovoltaic panels	+ 11.8	-£ 355	-949 kg (118.7%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£54	2.13 kg/m ²	B 88	B 89
Solar photovoltaic panels	£355	13.95 kg/m ²	A 100	A 100
Total Savings	£410	16.08 kg/m ²		

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£354	£300	£54
Space heating	£159	£160	-£0
Water heating	£136	£81	£55
Lighting	£59	£59	£0
Generated (PV)	-£0	-£355	£355
Total cost of fuels	£354	-£55	£409
Total cost of uses	£354	-£55	£410
Delivered energy	27 kWh/m ²	-4 kWh/m ²	31 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m ²	14 kg/m ²	-2 kg/m ²	16 kg/m ²
Primary energy	82 kWh/m ²	-13 kWh/m ²	95 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3039	0.3039	0.2959	0.3199	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5832	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5647	0.5706 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	40.1810	39.9585	39.7404	38.7161	38.5244	37.6323	37.6323	37.4671	37.9759	38.5244	38.9121	39.3175 (38)
Heat transfer coeff	101.3157	101.0932	100.8751	99.8508	99.6591	98.7670	98.7670	98.6017	99.1106	99.6591	100.0468	100.4521 (39)
Average = Sum(39)m / 12 =												99.8498 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4891	1.4858	1.4826	1.4675	1.4647	1.4516	1.4516	1.4492	1.4567	1.4647	1.4704	1.4764 (40)
HLP (average)												1.4675 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1976 (42)
Average daily hot water use (litres/day)												86.3934 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

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[illegible]

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9439	38.1424	31.0195	23.4837	17.5544	14.8201	16.0137	20.8152	27.9381	35.4738	41.4032	44.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5821	290.5663	283.0462	267.0368	246.8278	227.8342	215.1453	212.1611	219.6812	235.6906	255.8996	274.8932 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833 (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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046 (71)
Water heating gains (Table 5)	111.7565	109.7608	104.1158	92.4786	82.5675	77.1669	72.7892	79.3988	88.3954	98.7292	106.8146	109.7692 (72)
Total internal gains	536.6181	532.8051	512.5171	477.3347	441.2853	414.1569	398.2839	406.7107	430.3504	464.2293	498.4530	523.1354 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					9.4500	19.6403	0.6300	0.7000	0.7700	56.7219 (76)		
South					2.5300	46.7521	0.6300	0.7000	0.7700	36.1487 (78)		
West					5.4900	19.6403	0.6300	0.7000	0.7700	32.9527 (80)		
Solar gains	125.8234	234.6250	364.3094	506.5711	605.1837	614.0674	586.7558	513.3810	414.7762	272.0090	154.6623	104.9799 (83)
Total gains	662.4415	767.4301	876.8265	983.9059	1046.4690	1028.2243	985.0397	920.0918	845.1266	736.2383	653.1154	628.1153 (84)

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	41.0064	41.0967	41.1855	41.6080	41.6881	42.0646	42.0646	42.1351	41.9188	41.6881	41.5265	41.3589
alpha	3.7338	3.7398	3.7457	3.7739	3.7792	3.8043	3.8043	3.8090	3.7946	3.7792	3.7684	3.7573
util living area	0.9814	0.9673	0.9354	0.8631	0.7403	0.5736	0.4300	0.4755	0.7008	0.9012	0.9684	0.9845 (86)
Tweekday	18.1568	18.3980	18.7664	19.1859	19.4613	19.5916	19.6159	19.6153	19.5446	19.1812	18.6033	18.1184
Tweekend	20.2317	20.3398	20.5078	20.7041	20.8479	20.9245	20.9464	20.9429	20.8901	20.6943	20.4267	20.2113
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8142	19.9788	20.2404	20.5379	20.7653	20.8841	20.9173	20.9119	20.8284	20.5282	20.1048	19.7827 (87)
Th 2	19.6957	19.6982	19.7006	19.7119	19.7141	19.7240	19.7240	19.7258	19.7202	19.7141	19.7098	19.7053 (88)
util rest of house	0.9761	0.9581	0.9172	0.8255	0.6734	0.4748	0.3106	0.3519	0.6057	0.8648	0.9578	0.9801 (89)

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Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	18.1568	18.3980	18.7664	19.1859	19.4613	19.5916	19.6159	19.6153	19.5446	19.1812	18.6033	18.1184
Tweekend	18.1568	18.3980	18.7664	19.1859	19.4613	19.5916	19.6159	19.6153	19.5446	19.1812	18.6033	18.1184
MIT 2	18.1568	18.3980	18.7664	19.1859	19.4613	19.5916	19.6159	19.6153	19.5446	19.1812	18.6033	18.1184 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	18.9616	19.1656	19.4822	19.8424	20.0945	20.2192	20.2478	20.2449	20.1680	19.8353	19.3324	18.9266 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9616	19.1656	19.4822	19.8424	20.0945	20.2192	20.2478	20.2449	20.1680	19.8353	19.3324	18.9266 (93)

8. Space heating requirement

Utilisation	Jan 0.9722	Feb 0.9534	Mar 0.9136	Apr 0.8298	May 0.6947	Jun 0.5147	Jul 0.3607	Aug 0.4037	Sep 0.6414	Oct 0.8688	Nov 0.9539	Dec 0.9766 (94)
Useful gains	644.0412	731.7061	801.0512	816.4565	726.9789	529.2007	355.2659	371.3967	542.1038	639.6411	623.0382	613.4034 (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	1485.4533	1442.1567	1309.5795	1092.6117	836.5892	554.9957	360.2850	379.1160	601.4023	920.3802	1223.8157	1479.3157 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	626.0106	477.4228	378.3450	198.8317	81.5501	0.0000	0.0000	0.0000	0.0000	208.8699	432.5598	644.2388 (98)
Space heating per m2												3047.8287 (98)
											(98) / (4) =	44.7947 (99)

8c. Space cooling requirement

Not applicable

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 %)												307.3153 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												991.7593 (211)
Space heating requirement	Jan 626.0106	Feb 477.4228	Mar 378.3450	Apr 198.8317	May 81.5501	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 208.8699	Nov 432.5598	Dec 644.2388 (98)
Space heating efficiency (main heating system 1)	307.3153	307.3153	307.3153	307.3153	307.3153	0.0000	0.0000	0.0000	0.0000	307.3153	307.3153	307.3153 (210)
Space heating fuel (main heating system)	203.7030	155.3527	123.1130	64.6996	26.5363	0.0000	0.0000	0.0000	0.0000	67.9660	140.7544	209.6344 (211)
Water heating 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 (215)
Water heating requirement	162.5913	124.6824	103.8040	57.7671	27.4516	13.4689	9.2258	36.3705	63.2596	108.5480	141.4693	162.0114 (64)
Efficiency of water heater (217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150 (216)
Fuel for water heating, kWh/month	59.9051	45.9379	38.2455	21.2837	10.1142	4.9625	3.3992	13.4003	23.3073	39.9934	52.1229	59.6914 (219)
Water heating fuel used												372.3634 (219)
Annual totals kWh/year												
Space heating fuel - main system												991.7593 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												303.3611 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												-9.7555 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	991.7593	13.1900	130.8131 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	372.3634	13.1900	49.1147 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	303.3611	13.1900	40.0133 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			-1.2868 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	-0.0048 (257)
SAP value		100.0667

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

100 (258)
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	991.7593	0.5190	514.7231 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	372.3634	0.5190	193.2566 (264)
Space and water heating			707.9797 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	303.3611	0.5190	157.4444 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			-5.0631 (272)
CO2 emissions per m2			-0.0700 (273)
EI value			100.0600
EI rating			100 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	33.0400 (1b)	x 2.4000 (2b)	= 79.2960 (1b) - (3b)
First floor	35.0000 (1c)	x 3.7000 (2c)	= 129.5000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 208.7960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0958 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3458 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3199 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	4.0000	3.6000	3.6000	3.3000	3.4000	3.7000	3.6000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	1.0000	0.9000	0.9000	0.8250	0.8500	0.9250	0.9000	1.0000 (22a)
Adj infilt rate	0.3438	0.3278	0.3278	0.3039	0.3199	0.2879	0.2879	0.2639	0.2719	0.2959	0.2879	0.3199 (22b)
Effective ac	0.5591	0.5537	0.5537	0.5462	0.5512	0.5414	0.5414	0.5348	0.5370	0.5438	0.5414	0.5512 (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
Door			4.0100	1.4000	5.6140		(26)
Windows (Uw = 1.00)			17.4700	0.9615	16.7981		(27)
Main Floor			33.0400	0.1400	4.6256	110.0000	3634.4000 (28a)
Main Wall	93.8000	21.4800	72.3200	0.2000	14.4640	60.0000	4339.2000 (29a)
Slope	48.3000		48.3000	0.1400	6.7620	9.0000	434.7000 (30)
Total net area of external elements Aum(A, m ²)			175.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.2637		(33)
Party Wall 1			36.5800	0.0000	0.0000	140.0000	5121.2000 (32)
Internal Wall 1			22.0800			9.0000	198.7200 (32c)
Internal Wall 2			4.3200			9.0000	38.8800 (32c)
Internal Floor 1			33.0400			18.0000	594.7200 (32d)
Internal Ceiling 1			33.0400			18.0000	594.7200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14956.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 219.8198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8710 (36)
Total fabric heat loss (33) + (36) = 61.1347 (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	38.5244	38.1544	38.1544	37.6323	37.9759	37.3063	37.3063	36.8503	36.9979	37.4671	37.3063	37.9759 (38)
Heat transfer coeff	99.6591	99.2890	99.2890	98.7670	99.1106	98.4409	98.4409	97.9849	98.1325	98.6017	98.4409	99.1106 (39)
Average = Sum(39)m / 12 =												98.7723 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4647	1.4593	1.4593	1.4516	1.4567	1.4468	1.4468	1.4401	1.4423	1.4492	1.4468	1.4567 (40)
HLP (average)												1.4517 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.1976 (42)
Average daily hot water use (litres/day) 86.3934 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	95.0327	91.5770	88.1212	84.6655	81.2098	77.7540	77.7540	81.2098	84.6655	88.1212	91.5770	95.0327 (44)
Energy conte	140.9308	123.2589	127.1922	110.8892	106.4009	91.8158	85.0809	97.6316	98.7976	115.1391	125.6833	136.4839 (45)
Energy content (annual)										Total = Sum(45)m =		1359.3041 (45)

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Distribution loss (46)m = 0.15 x (45)m	21.1396	18.4888	19.0788	16.6334	15.9601	13.7724	12.7621	14.6447	14.8196	17.2709	18.8525	20.4726 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (56)												
If cylinder contains dedicated solar storage												
22.0968 19.9584 22.0968 21.3840 22.0968 21.3840 22.0968 22.0968 21.3840 22.0968 21.3840 22.0968 (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)
Total heat required for water heating calculated for each month	186.2900	164.2285	171.1556	148.0316	138.9657	123.1051	117.4131	130.8943	137.2907	159.1025	169.5793	181.8431 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1142.6174 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1919.5973 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4122 (H8)
Utilisation factor												0.5074 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												86.3934 (H14)
Volume ratio Veff/V												0.8681 (H15)
Solar storage volume factor												0.9717 (H16)
Solar input												-832.2609 (H17)
Solar input	-26.3723	-38.3635	-65.2843	-89.9287	-107.6449	-113.3035	-111.1226	-98.7275	-77.0342	-53.1075	-30.2276	-21.1443 (63)
Solar input (sum of months) = Sum (63)m =												-832.2609 (63)
Output from w/h	159.9177	125.8651	105.8713	58.1029	31.3208	9.8016	6.2906	32.1668	60.2565	105.9950	139.3517	160.6988 (64)
Total per year (kWh/year) = Sum (64)m =												995.6388 (64)
Heat gains from water heating, kWh/month	83.1468	73.7593	77.4622	66.5846	61.4302	55.5602	54.1552	59.0727	63.6447	73.4545	76.9065	81.6683 (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)
(66)m	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	131.8569	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.9439	38.1424	31.0195	23.4837	17.5544	14.8201	16.0137	20.8152	27.9381	35.4738	41.4032	44.1374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.5821	290.5663	283.0462	267.0368	246.8278	227.8342	215.1453	212.1611	219.6812	235.6906	255.8996	274.8932	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	50.3833	(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)	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	-87.9046	(71)
Water heating gains (Table 5)	111.7565	109.7608	104.1158	92.4786	82.5675	77.1669	72.7892	79.3988	88.3954	98.7292	106.8146	109.7692	(72)
Total internal gains	536.6181	532.8051	512.5171	477.3347	441.2853	414.1569	398.2839	406.7107	430.3504	464.2293	498.4530	523.1354	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East					9.4500	23.0580		0.6300	0.7000	0.7700		66.5924 (76)
South					2.5300	52.5273		0.6300	0.7000	0.7700		40.6141 (78)
West					5.4900	23.0580		0.6300	0.7000	0.7700		38.6870 (80)

Solar gains	145.8935	237.0509	367.4430	524.5976	606.8598	659.1205	625.9980	557.1999	448.9038	297.5083	173.2725	116.6350 (83)
Total gains	682.5116	769.8560	879.9601	1001.9324	1048.1451	1073.2774	1024.2819	963.9106	879.2542	761.7375	671.7255	639.7704 (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	41.6881	41.8434	41.8434	42.0646	41.9188	42.2039	42.2039	42.4003	42.3366	42.1351	42.2039	41.9188	
alpha	3.7792	3.7896	3.7896	3.8043	3.7946	3.8136	3.8136	3.8267	3.8224	3.8090	3.8136	3.7946	
util living area	0.9755	0.9610	0.9180	0.8159	0.6521	0.4127	0.2489	0.2928	0.5816	0.8550	0.9564	0.9799 (86)	
Tweekday	18.3709	18.5711	18.9569	19.3465	19.5505	19.6199	19.6238	19.6290	19.6052	19.3523	18.8135	18.3275	
Tweekend	20.3215	20.4111	20.5899	20.7803	20.8985	20.9473	20.9535	20.9530	20.9276	20.7756	20.5162	20.2996	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9528	20.0891	20.3670	20.6569	20.8433	20.9190	20.9282	20.9275	20.8870	20.6537	20.2445	19.9191 (87)	
Th 2	19.7141	19.7182	19.7182	19.7240	19.7202	19.7276	19.7276	19.7327	19.7311	19.7258	19.7276	19.7202 (88)	
util rest of house	0.9682	0.9497	0.8943	0.7662	0.5676	0.3029	0.1276	0.1658	0.4674	0.8021	0.9414	0.9738 (89)	

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Tweekday	18.3709	18.5711	18.9569	19.3465	19.5505	19.6199	19.6238	19.6290	19.6052	19.3523	18.8135	18.3275
Tweekend	18.3709	18.5711	18.9569	19.3465	19.5505	19.6199	19.6238	19.6290	19.6052	19.3523	18.8135	18.3275
MIT 2	18.3709	18.5711	18.9569	19.3465	19.5505	19.6199	19.6238	19.6290	19.6052	19.3523	18.8135	18.3275 (90)
Living area fraction									fLA = Living area / (4) =			0.4856 (91)
MIT	19.1391	19.3082	19.6416	19.9828	20.1783	20.2508	20.2572	20.2596	20.2277	19.9843	19.5084	19.1004 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1391	19.3082	19.6416	19.9828	20.1783	20.2508	20.2572	20.2596	20.2277	19.9843	19.5084	19.1004 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9641	0.9453	0.8926	0.7772	0.5995	0.3488	0.1783	0.2190	0.5142	0.8143	0.9382	0.9701	(94)
Useful gains	658.0244	727.7123	785.4892	778.7482	628.3371	374.4086	182.6154	211.1065	452.1016	620.2577	630.2036	620.6306	(95)
Ext temp.	5.2000	5.7000	7.6000	10.2000	13.3000	16.4000	18.4000	18.1000	15.4000	11.8000	8.1000	5.2000	(96)
Heat loss rate W													
	1389.1543	1351.1484	1195.6037	966.2206	681.7095	379.0719	182.8256	211.6057	473.7512	806.9814	1123.0554	1377.6737	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	543.9606	418.9490	305.1252	134.9801	39.7090	0.0000	0.0000	0.0000	0.0000	138.9224	354.8533	563.2401	(98)
Space heating													2499.7398 (98)
Space heating per m2													36.7393 (99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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 %)													304.6604 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													820.5005 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	543.9606	418.9490	305.1252	134.9801	39.7090	0.0000	0.0000	0.0000	0.0000	138.9224	354.8533	563.2401	(98)
Space heating efficiency (main heating system 1)	304.6604	304.6604	304.6604	304.6604	304.6604	0.0000	0.0000	0.0000	0.0000	304.6604	304.6604	304.6604	(210)
Space heating fuel (main heating system)	178.5466	137.5135	100.1526	44.3051	13.0339	0.0000	0.0000	0.0000	0.0000	45.5991	116.4750	184.8747	(211)
Water heating 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	(215)
Water heating													
Water heating requirement	159.9177	125.8651	105.8713	58.1029	31.3208	9.8016	6.2906	32.1668	60.2565	105.9950	139.3517	160.6988	(64)
Efficiency of water heater													(216)
(217)m	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	271.4150	(217)
Fuel for water heating, kWh/month	58.9200	46.3737	39.0072	21.4074	11.5398	3.6113	2.3177	11.8515	22.2009	39.0527	51.3427	59.2078	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													820.5005 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													50.0000 (231)
Electricity for lighting (calculated in Appendix L)													303.3611 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1143 * 0.80) =										-1828.1879		-1828.1879	(233)
Total delivered energy for all uses													-287.4936 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	820.5005	19.4400	159.5053 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	366.8326	19.4400	71.3123 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	50.0000	19.4400	9.7200 (249)	
Energy for lighting	303.3611	19.4400	58.9734 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1828.1879	19.4400	-355.3997 (252)	
Total energy cost			-55.8888 (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	820.5005	0.5190	425.8398 (261)	

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Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	366.8326	0.5190	190.3861 (264)
Space and water heating			616.2259 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	303.3611	0.5190	157.4444 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	0.5190	-948.8295 (269)
Total kg/year			-149.2092 (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	820.5005	3.0700	2518.9365 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	366.8326	3.0700	1126.1762 (264)
Space and water heating			3645.1127 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	303.3611	3.0700	931.3186 (268)
Energy saving/generation technologies			
PV Unit	-1828.1879	3.0700	-5612.5368 (269)
Primary energy kWh/year			-882.6055 (272)
Primary energy kWh/m2/year			-12.9719 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	219.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	551.22 (P1)
Transmission heat loss coefficient	61.13 (37)
Summer heat loss coefficient	612.36 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	9.4500	117.5071	0.6300	0.7000	0.9000	396.6609
South	2.5300	112.2060	0.6300	0.7000	0.9000	101.4052
West	5.4900	117.5071	0.6300	0.7000	0.9000	230.4411
total:						728.5072

	Jun	Jul	Aug	
Solar gains	771	729	652	(P3)
Internal gains	428	412	420	
Total summer gains	1199	1141	1071	(P5)
Summer gain/loss ratio	1.96	1.86	1.75	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 219.8)	0.46	0.46	0.46	
Threshold temperature	18.42	20.22	20.01	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019665	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 4, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	16.55
Environmental	88 B	TER	31.96
CO ₂ Emissions (t/year)	0.94	% DER<TER	48.21
General Requirements Compliance	Pass	DFEE	59.37
		TFEE	66.50
		% DFEE<TFEE	10.71
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.96	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.55	kgCO ₂ /m ²	Pass
	-15.41 (-48.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	66.50	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	59.37	kWh/m ² /yr	
	-7.1 (-10.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.07 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Samsung Electronics AE050RXYDEG	
Secondary heating system	None	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.32 kWh/day
Permitted by DBSCG 2.03

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing East

9.45 m², No overhang

Windows facing South

2.53 m², No overhang

Windows facing West

5.49 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Window U-value

1.00 W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	019665	Issued on Date	13/06/2022
Assessment Reference	001	Prop Type Ref	
Property	Plot 4, 1178 -1184, Uxbridge Road, HAYES, UB4 8JB		
SAP Rating	86 B	DER	16.55
Environmental	88 B	% DER<TER	48.21
CO ₂ Emissions (t/year)	0.94	DFEE	59.37
General Requirements Compliance	Pass	% DFEE<TFEE	10.71
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID
Client	7869-0001		

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

Orientation	West						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Urban						
1.0 Property Type	House, End-Terrace						
2.0 Number of Storeys	2						
3.0 Date Built	2022						
4.0 Sheltered Sides	1						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
		Heat Loss Perimeter		Internal Floor Area		Average Storey Height	
Ground Floor:		17.60 m		33.04 m ²		2.40 m	
1st Storey:		16.60 m		35.00 m ²		3.70 m	
7.0 Living Area	33.04			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	219.82			kJ/m ² K			
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)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.20	60.00	93.80	72.32
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Filled Cavity with Edge Sealing	Dense plaster both sides. lightweight aggregate blocks, cavity or cavity fill		0.00	140.00	36.58	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame				9.00	22.08	
Internal Wall 2	Plasterboard on timber frame				9.00	4.32	
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)
Slope	External Slope Roof	Plasterboard, insulated slope		0.14	9.00	48.30	48.30

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	33.04

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	33.04

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	33.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Main Wall	North							1.91	
Front Windows	Window	[1] Main Wall	West	None	0.00					5.49	
Rear Door	Solid Door	[1] Main Wall	East							2.10	
Rear Windows	Window	[1] Main Wall	East	None	0.00					9.45	
Side Windows	Window	[1] Main Wall	South	None	0.00					2.53	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	9.90	0.300	No
Table K1 - Approved	E3 Sill	6.30	0.040	No
Table K1 - Approved	E4 Jamb	30.30	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	17.60	0.160	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	16.60	0.070	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	11.60	0.040	No
Table K1 - Approved	E16 Corner (normal)	12.40	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	2.40	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	7.60	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	6.90	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.70	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	7.70	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	7.70	0.080	No

Y-value	0.073	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	8	
Total number of L.E.L. fittings	8	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Database		
Percentage of Heat	100	%
Database Ref. No.	104361	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

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
SAP Code	901
Immersion Only Heating Hot Water	Yes

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	170.00	L
Loss	1.32	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store	None
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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
Solar water heating	£4,000 - £6,000	£54	B 88	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£355	A 100	

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000632	Issued on Date	13/06/2022
Block Name	Uxbridge Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761 035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
019662-001	1	59.22	18.70	34.49	45.79 %
019663-001	1	59.22	17.99	31.76	43.36 %
019664-001	1	59.22	17.98	31.73	43.34 %
019665-001	1	68.04	16.55	31.96	48.21 %
Totals:	4	245.7	71.22	129.94	
Average DER = 17.76 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 32.47 kgCO ₂ /m ²		45.30 %			

Block Compliance Report - DFEE

Block Reference: 000632		Block Name: Uxbridge Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
019662-001	1	59.22	65.79	71.59	8.11 %
019663-001	1	59.22	57.00	62.48	8.77 %
019664-001	1	59.22	56.95	62.39	8.72 %
019665-001	1	68.04	59.37	66.50	10.71 %
Totals:	4	245.7	239.10	262.95	
Average DFEE = 59.76 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 65.76 kWh/m ² /yr		9.12 %			