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ENERGY STATEMENT

Proposed development at:
105 Lion Lane, Turners Hill, Crawley, RH10 4NU



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¹ Achieve Green and Energytest are trading names of Achieve Green Ltd, Company Registration No. 7013944



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1. Executive Summary

This Energy Statement has been prepared by Achieve Green in support of a full planning application for the continued use of 105 Lion Lane, Turners Hill, RH10 4NU as a residential dwelling.

The design has been developed to address the Renewable and Low Carbon Energy requirements of Mid Sussex District Council.

A base case has been developed, against which potential savings can be assessed. As this development is a refurbishment, the baseline has been established based on the unimproved performance of the building.

This proposed development features improved insulation and air tightness standards, when compared against the compliance requirements of Approved Document L1 2021 of the Building Regulations. In addition, this proposed development will incorporate a mechanical and electrical specification that surpasses the requirements of Approved Document L1 2021.

Having minimised energy consumption in the first instance, the potential for remaining energy demands to be met via a decentralised energy source has been considered. It is evident this proposed development is neither within the coverage of an existing district heating network, nor is there an expectation that a district heating network will be developed at this site in the near future.

Due to its size, this development is not suitable for combined heat and power.

An assessment has been carried out to determine the potential for renewable energy systems to reduce CO₂ emissions further. There is potential for a heat pump to be installed in order to meet the expectations of the Local Planning Authority.

The total reduction in emissions resulting from energy efficiency measures and the installation of renewable technology is 74% compared to the regulated emissions from the original building.

2. Introduction

Energy use in buildings is a significant contributor to global CO₂ emissions and global warming. Designing energy efficient buildings and incorporating low and zero carbon energy generation is a vital part of ensuring this development incorporates sustainability as a core part of its design.

The purpose of the report is to assist evaluating parties to understand the energy consumption and performance of the proposed development and consider its performance against the "lean, clean, green" performance standard.

2.1. Overview of the proposed development

The proposed development relates to the continued use of the property as a detached dwelling

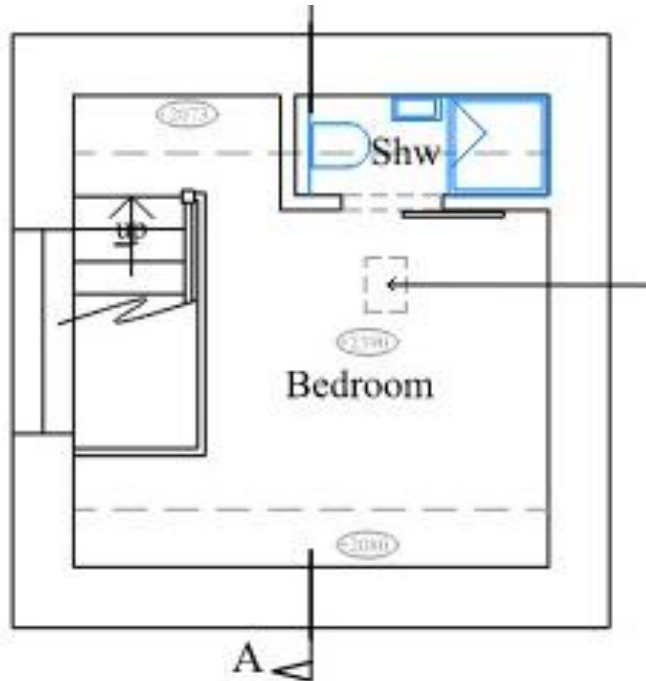
Lower ground floor plan:



Ground floor plan:



First floor plan:



3. Policies and Drivers

3.1. National and International Policy

The Climate Change Act (2008) sets a legally binding target for reducing UK carbon dioxide (CO₂) emissions to net zero by 2050. It also provides for a Committee on Climate Change, which sets out carbon budgets binding on the Government for 5-year periods.

The National Planning Policy Framework (NPPF) December 2024 reflects the requirements of the Climate Change Act 2008 in paragraphs 162, 164, and 165 as follows:

"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating and drought from rising temperatures. Policies should support appropriate measures to ensure the future health and resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure."

"New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and b) can help to reduce greenhouse gas emissions, such as through its location, orientation and



design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards."

"To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."

3.2. Local Policy: Mid Sussex District Council

Sustainability is key to Mid Sussex District Council planning policy and should be considered with every planning application:

3.2.1. Project policy

DP39: Sustainable Design and Construction

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.
Evidence Base: Gatwick Sub Region Water Cycle Study; West Sussex Sustainable Energy Study, Mid Sussex Sustainable Energy Study.

All development proposals must seek to improve the sustainability of development and should where appropriate and feasible according to the type and size of development and location, incorporate the following measures:

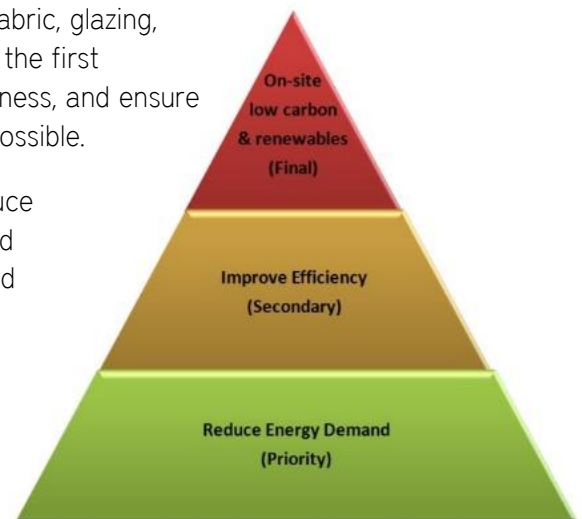
- **Minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation;**
- **Explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible;**
- **Use renewable sources of energy;**
- **Maximise efficient use of resources, including minimising waste and maximising recycling/re-use of materials through both construction and occupation;**
- **Limit water use to 110 litres/person/day in accordance with Policy DP42: Water Infrastructure and the Water Environment;**
- **Demonstrate how the risks associated with future climate change have been planned for as part of the layout of the scheme and design of its buildings to ensure its longer term resilience**

4. Energy hierarchy

In line with best practice the proposed energy strategy for this development will follow the principals of the energy hierarchy.

The energy hierarchy has three priorities, seeking to reduce energy use before meeting remaining demand by the cleanest means possible:

- 1) Be lean – use less energy: Optimise the building fabric, glazing, and structure to minimise energy consumption in the first instance by using low U-values and good air tightness, and ensure that active systems run as energy efficiently as possible.
- 2) Be clean – supply energy efficiently: Further reduce carbon emissions through the use of decentralised energy where feasible, such as combined heat and power (CHP).
- 3) Be green – use renewable energy: When the above design elements have been reasonably exhausted, supply energy through renewable sources where practical.



5. Establishing the baseline

For buildings that are subject to a material change of use, the baseline is established by applying the minimum standards of Approved Document L1.

The baseline calculations are based on buildings that are the same size and shape as the proposed building and have the same exposed facades.

6. Energy efficient design measures (“be lean”)

Enhancing the thermal performance of the building envelope helps to future-proof the structure and also yields the greatest CO₂ savings. Adding renewable technology will then yield maximum carbon reductions with lower long-term costs for the developer.

The proposed domestic development will achieve compliance with Approved Document L1 2021 without reliance on the contribution of renewable technology.

The following energy-efficient design measures are proposed:



	Proposed development	Original Building
External wall U-value (W/m ² K)	0.33-0.39	2.1-2.5
Roof U-value (W/m ² K)	0.21-0.35	2.3
Ground floor U-value (W/m ² K)	0.22	0.67
Single glazed window U-value (W/m ² K)	4.8	4.8

Having reduced energy demand through improvements to the fabric, this development shall seek to reduce energy consumption further through the specification of mechanical and electrical systems with efficiencies that surpass the requirements of Approved Document L1 2021:

	Proposed development	Original Building
Lighting	80 Lm/W	75 Lm/W

7. Energy efficient systems (“be clean”)

7.1. Combined heat and power

Combined heat and power (CHP) systems use relatively cheap and clean fuels (such as natural gas) to generate heat and electricity on site. A typical CHP system uses combustion of natural gas to drive a turbine that produces electricity. The heat generated is captured and used to produce hot water.

As losses are minimised the carbon footprint of the energy generated is very low. However this is dependent on there being sufficient year-round local heat demand to fully utilise the heat generated by the CHP plant. An example would be developments of at least 500 dwellings, universities or hospitals.

Due to its size, this development is not suitable for combined heat and power.

7.2. District heating networks

In a district heating network heat is supplied from one or more central energy centres to multiple buildings within the network. Supply to multiple buildings guarantees high year-round local heat demand which in turn allows the use of low carbon technologies within the energy centre, such as combined heat and power systems. Large plant and aggregated demand allows systems within the energy centre to run more efficiently.

Hot water is distributed within the network via highly insulated pipes. To connect to the network individual boilers are replaced with separately metered heat exchangers.

Due to the fact this proposed development is neither within the coverage of an existing district heating network, nor is it within an area designated as having potential for a future network, district heating can be discounted as a viable option.

8. Low and zero carbon energy sources (“be green”)

8.1. Photovoltaics

Solar photovoltaics (PV) capture the sun's energy using photovoltaic cells. The cells convert sunlight into electricity, which can be utilised on site or transferred into the National Grid. PV cells are made from layers of semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced. Groups of cells are mounted together in panels or modules that can be mounted on a roof.

The power of a PV cell is measured in kilowatts peak (kWp). This is the rate at which the cell generates energy at peak performance in full direct sunlight.

Photovoltaics offer high CO₂ savings, are simple to install and suitable for most buildings. The only limiting factor for PV is the availability of suitable roof space.

8.2. Heat Pumps

Heat pumps collect low temperature heat from renewable sources (such as the air or ground) and concentrate the heat to a usable temperature via a reverse refrigeration cycle. Useable heat is transferred to the dwelling via a heat exchanger and can be used for low temperature central heating and domestic hot water, though an immersion top-up may be required for DHW.

Heat pumps have some impact on the environment as they generally use grid supplied electricity to run the pumps. It is common for heat pumps to have a coefficient of performance of three, meaning that for every 1kWh of electricity used, over 3kWh of heat can be generated. The renewable component of the output is therefore taken as the difference between the output energy and the input energy, in this scenario the heat pump will be deemed to have delivered 2kWh of renewable energy.

Ground source heat pumps require external horizontal ground loops, or as is more likely in built-up environments, vertical loops fed into bore holes. The application of ground source heat pumps is therefore constrained by site ground conditions and available space.

Air source heat pumps have a slightly lower seasonal efficiency than ground source heat pumps, but require less space. Noise and space considerations should be assessed when determining an appropriate site for external condensing units.



Heat pumps are a very good option for sites not connected to the gas network, or as a replacement of existing electric or oil-fired heating systems.

8.3. Solar thermal

Solar thermal systems, use free heat from the sun to warm domestic hot water. A conventional boiler, heat pump or immersion heater can be used to make the water hotter, or to provide hot water when solar energy is unavailable.

Solar thermal systems are most appropriate for buildings with high year-round domestic hot water demand. Although a typical solar thermal system will be able to meet half the annual domestic hot water demand for a dwelling, many will use electricity to run pumps within the system.

8.4. Wind turbines

Wind turbines use blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. The stronger the wind, the more electricity produced.

There are two types of domestic-sized wind turbine: Pole mounted and building mounted. Pole mounted turbines are free standing and are erected in a suitably exposed position, and are often about 5kW to 6kW in size. Building mounted turbines are smaller and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size.

Large scale turbines, in exposed locations offer one of the best financial returns of all renewable energy systems as the payback of the system increases dramatically with the size of the turbine. However small-scale systems offer much lower levels of performance and recent studies have questioned the viability and output from such systems, particularly in urban environments.

8.5. Biomass

Biomass heating systems, burn wood pellets, chips or logs to provide warmth in a single room or to power central heating and hot water boilers. The carbon dioxide emitted when wood is burned is the same amount that was absorbed over the months and years that the plant was growing. The process is sustainable as long as new plants continue to grow in place of those used for fuel. There are some carbon emissions caused by the cultivation, manufacture and transportation of the fuel, but as long as the fuel is sourced locally, these are much lower than the emissions from fossil fuels.

When specifying biomass heating systems is important to consider the potential technical issues surrounding delivery and storage of fuel.

Although the CO₂ savings from biomass are substantial, the high levels of NO_x emissions can make biomass systems unsuitable for urban environments.

8.6. Proposed low and zero carbon energy sources

With carbon emissions within the building already reduced through an enhanced fabric and energy efficient systems, it is proposed that a further reduction will be achieved through the installation of **air source heat pump hot water cylinders** to serve all of the Domestic Hot Water requirements.

9. Results: Calculated CO₂ savings

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)
	Regulated
Baseline	2.0
After energy demand reduction and renewable energy	0.5

Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Total Cumulative Savings	1.5	74.2



10. Conclusion

The proposed refurbishment of 105 Lion Lane is compliant with national and local sustainability requirements through the application of the energy hierarchy.

10.1. Policy Compliance

The development supports the Climate Change Act 2008 and the NPPF by reducing CO2 emissions and enhancing climate resilience. The fabric improvements align with the "material change of use" requirements of Approved Document L1 2021.

The strategy also fulfils Mid Sussex District Council Policy DP39. By prioritizing "Be Lean" measures (improved U-values) and "Be Green" technologies (ASHP for hot water), the development achieves a high standard of sustainable design.

10.2. Summary of Performance

The proposed design shall deliver a 74.2% reduction in regulated CO2 emissions compared to the original building baseline. This is achieved through Enhanced Fabric (e.g. significant improvements to wall and floor insulation) and Low Carbon Heat, with the installation of an air source heat pump to meet 100% of the domestic hot water demand.

11. Appendix A: Water consumption calculations

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)				yorkshire LABC	
Project Details					
Address/Reference		105 Lion Lane, Turners Hill, Crawley, RH10 4NU		Case Reference	
Number of Bedrooms		1		Occupancy for Calculation Purposes	
				2	
Appliance/Useage Details					
Taps (Excluding Kitchen Taps)					
Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type		
Bathroom sink mixer taps	5.00	1	5.00		
			0.00		
			0.00		
			0.00		
			0.00		
			0.00		
Total No. of Fittings (No.)		1			
Total Flow (l/s)			5.00		
Maximum Flow (l/s)			5.00		
Average Flow (l/s)			5.00		
Weighted Average Flow (l/s)			3.50		
Flow for Calculation (l/s)			5.00		
Showers					
Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type		
Shower	8.00	1	8.00		
			0.00		
			0.00		
			0.00		
			0.00		
			0.00		
Total No. of Fittings (No.)		1			
Total Flow (l/s)			8.00		
Maximum Flow (l/s)			8.00		
Average Flow (l/s)			8.00		
Weighted Average Flow (l/s)			5.60		
Flow for Calculation (l/s)			8.00		
Baths					
Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type		
			0.00		
			0.00		
			0.00		
			0.00		
Total No. of Fittings (No.)		0			
Total Capacity (l)			0.00		
Maximum Capacity (l)			0.00		
Average Capacity (l)			0.00		
Weighted Average Capacity (l)			0.00		
Capacity for Calculation (l)			0.00		
Dishwashers					
Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type		
			0.00		
			0.00		
Total No. of Fittings (No.)		0			
Total Consumption (l)			1.25		
Maximum Consumption (l)			1.25		
Average Consumption (l/s)			1.25		
Weighted Average Consumption (l)			0.88		
Consumption for Calculation (l/s)			1.25		
Kitchen Taps					
Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type		
Kitchen tap	10.00	1	10.00		
			0.00		
			0.00		
Total No. of Fittings (No.)		1			
Total Flow (l/s)			10.00		
Maximum Flow (l/s)			10.00		
Average Flow (l/s)			10.00		
Weighted Average Flow (l/s)			7.00		
Flow for Calculation (l/s)			10.00		
WCs					
WC Type	Full Flush Volume	Part Flush Volume	Quantity (No.)		
WC	6.00	3.00	1		
Total number of fittings			1		
Average effective flushing volume			N/a		
Washing Machines					
Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type		
Washing machine	5.00	1	5.00		
			0.00		
Total No. of Fittings (No.)		1			
Total Consumption (l)			5.00		
Maximum Consumption (l)			5.00		
Average Consumption (l/s)			5.00		
Weighted Average Consumption (l)			3.50		
Consumption for Calculation (l/s)			5.00		
Other Fittings					
Waste Disposal Y/N		N			
Water softner					
Consumption beyond 4% l/p/d		0.00			
Use of grey water and harvested rainwater					
Total Grey water from WHB taps (l)		0			
Total Available Grey Water Supply (l)			89.60		
Possible Demand (l)			56.28		
Grey/Rain Installed Capacity (l)		0.00			
Figure for Calculation iit/person/day			0.00		
Water Use Assessment					
Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	6.00	1.46	0.00	8.76
	Pt Flush (l)	3.00	2.96	0.00	8.88
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	5.00	1.58	1.58	9.48
Bath (shower present)	(l/s)	0.00	0.11	0.00	0.00
Shower (bath present)	(l/s)	0.00	4.37	0.00	0.00
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	8.00	5.60	0.00	44.80
Kitchen Taps	(l/s)	10.00	0.44	10.36	14.76
Washing Machines	(l/kgdry)	5.00	2.10	0.00	10.50
Dishwashers	(l/place)	1.25	3.60	0.00	4.50
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					101.68
Grey/RainWater Reused (l)					0.00
Normalisation Factor (Factor)					0.91
Total Consumption CSH (l/p/day)					92.53
External Water Use Allowance (l)					5.00
Total Consumption Part G (l/p/day)					97.53
Assesment Result					PASS

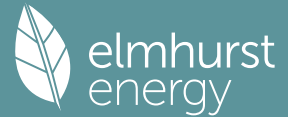
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12. Appendix B: SAP Reports

Full SAP Calculation Printout



Plot Reference	10278	Issued on Date	22/04/2026
Assessment Reference	Exsiting	Plot Type Ref	
Plot Address		SAP Version	10.2
SAP Rating	1 G	DER	54.11
Environmental	68 D	% DER < TER	N/A
CO ₂ Emissions (t/year)	1.81	DFEE	332.77
Compliance Check	N/A	% DFEE < TFEE	
% DPER < TPER		DPER	559.21
Assessor Details	Mr. Harry Davey	Assessor ID	R434-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Built) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 83.7240 (5)

2. Ventilation rate

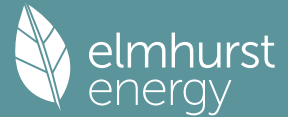
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.2389 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9889 (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) = 0.8405 (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	1.0717	1.0507	1.0297	0.9246	0.9036	0.7985	0.7985	0.7775	0.8405	0.9036	0.9456	0.9876 (22b)
Effective ac	1.0717	1.0507	1.0297	0.9274	0.9082	0.8188	0.8188	0.8023	0.8533	0.9082	0.9471	0.9877 (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
Main dwelling							
Door			0.5100	1.6000	0.8160		(26)
Window			5.1300	1.3258	6.8011		(27)
Heatloss Floor 1			12.3500	0.6700	8.2745	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	2.1000	58.8630	110.0000	3083.3000 (29a)
GF wall	32.5700	1.6000	30.9700	2.1000	65.0370	190.0000	5884.3000 (29a)
FF Wall	33.8800	2.1000	31.7800	2.5000	79.4500	9.0000	286.0200 (29a)
joists	9.1700		9.1700	2.3000	21.0910	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	2.3000	8.2570	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m ²)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		248.5896		(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11459.5600 (34)

Full SAP Calculation Printout



Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 317.0003 (35)
Thermal bridges (Default value 0.200 * total exposed area) 24.3060 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 272.8956 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	29.6099	29.0293	28.4487	25.6243	25.0936	22.6230	22.6230	22.1655	23.5747	25.0936	26.1672	27.2896
Heat transfer coeff	302.5055	301.9249	301.3443	298.5199	297.9892	295.5187	295.5187	295.0612	296.4703	297.9892	299.0629	300.1853
Average = Sum(39)m / 12 =												298.5075
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	8.3681	8.3520	8.3359	8.2578	8.2431	8.1748	8.1748	8.1621	8.2011	8.2431	8.2728	8.3039
HLP (average)												8.2575
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3082
Hot water usage for mixer showers												(42)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths												
19.9707	19.6741	19.2565	18.4864	17.9097	17.2703	16.9250	17.3397	17.7913	18.4755	19.2614	19.9032	(42b)
Hot water usage for other uses												
28.0272	27.0080	25.9889	24.9697	23.9505	22.9313	22.9313	23.9505	24.9697	25.9889	27.0080	28.0272	(42c)
Average daily hot water use (litres/day)												43.9953
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	47.9979	46.6822	45.2453	43.4561	41.8602	40.2017	39.8563	41.2902	42.7610	44.4643	46.2694	47.9304
Energy conte	76.0170	66.4748	69.5404	59.4892	56.3519	49.4326	48.2027	51.1259	52.7285	60.3377	65.9193	75.0474
Energy content (annual)												730.6675
Distribution loss (46)m = 0.15 x (45)m												
11.4025	9.9712	10.4311	8.9234	8.4528	7.4149	7.2304	7.6689	7.9093	9.0506	9.8879	11.2571	(46)
Water storage loss (or HIU loss):												
Store volume												150.0000
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0330
Volume factor from Table 2a												0.9283
Temperature factor from Table 2b												0.6000
Enter (49) or (54) in (55)												2.7592
Total storage loss												
85.5362	77.2585	85.5362	82.7770	85.5362	82.7770	85.5362	85.5362	82.7770	85.5362	82.7770	85.5362	(56)
If cylinder contains dedicated solar storage												
85.5362	77.2585	85.5362	82.7770	85.5362	82.7770	85.5362	85.5362	82.7770	85.5362	82.7770	85.5362	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837	(64)
Electric shower(s)												
36.9612	32.9328	35.9613	34.3174	34.9614	33.3498	34.4614	34.9614	34.3174	35.9613	35.2851	36.9612	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												420.4318
Heat gains from water heating, kWh/month												
102.9449	92.1429	100.5415	94.5811	95.9063	90.9954	93.0717	94.1687	92.3332	97.4816	96.9610	102.6225	(65)

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

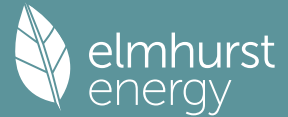
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
18.5606	16.4854	13.4068	10.1498	7.5871	6.4054	6.9212	8.9964	12.0750	15.3320	17.8947	19.0765	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)												
138.3668	137.1174	135.1364	131.3626	128.9064	126.3825	125.0964	126.5708	128.2405	131.0236	134.6681	137.9335	(72)
Total internal gains												
394.3931	392.8028	383.3725	367.0370	350.2725	335.5276	327.3826	329.1978	338.3168	353.6616	371.6144	387.1008	(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		2.1000	10.6334	0.6300	0.7000	0.7700	6.8244
East		1.0900	19.6403	0.6300	0.7000	0.7700	6.5425
West		1.9400	19.6403	0.6300	0.7000	0.7700	11.6445
Solar gains	25.0114	48.6194	80.7525	121.0484	152.6763	158.5380	149.9894
Total gains	419.4045	441.4222	464.1250	488.0855	502.9488	494.0656	477.3720

7. Mean internal temperature (heating season)

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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	10.5228	10.5431	10.5634	10.6633	10.6823	10.7716	10.7716	10.7883	10.7370	10.6823	10.6440	10.6042
alpha	1.7015	1.7029	1.7042	1.7109	1.7122	1.7181	1.7181	1.7192	1.7158	1.7122	1.7096	1.7069
util living area	0.9867	0.9847	0.9804	0.9717	0.9555	0.9244	0.8789	0.8930	0.9442	0.9726	0.9833	0.9874 (86)
MIT	15.6534	15.8907	16.4756	17.3499	18.3321	19.3197	19.9685	19.8849	19.0872	17.8566	16.6304	15.6223 (87)
Th 2	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000 (88)
util rest of house	0.9817	0.9787	0.9717	0.9561	0.9210	0.8244	0.5862	0.6439	0.8753	0.9536	0.9754	0.9827 (89)
MIT 2	12.6689	12.9608	13.6822	14.7547	15.9576	17.1317	17.8054	17.7393	16.8733	15.3817	13.8702	12.6249 (90)
Living area fraction									fLA = Living area / (4) =			0.2689 (91)
MIT	13.4714	13.7486	14.4333	15.4525	16.5960	17.7200	18.3870	18.3162	17.4686	16.0472	14.6123	13.4309 (92)
Temperature adjustment												0.0000
adjusted MIT	13.4714	13.7486	14.4333	15.4525	16.5960	17.7200	18.3870	18.3162	17.4686	16.0472	14.6123	13.4309 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9657	0.9608	0.9501	0.9285	0.8880	0.8054	0.6636	0.6988	0.8494	0.9270	0.9561	0.9674 (94)
Useful gains	405.0185	424.1131	440.9576	453.2067	446.5964	397.9216	316.7766	317.8603	367.8653	381.3878	385.0476	394.4689 (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	2774.3980	2671.6074	2390.6575	1956.0572	1458.9610	922.0285	528.1023	565.4007	998.6869	1623.1957	2246.6593	2770.9740 (97)
Space heating kWh	1762.8184	1510.3162	1450.5767	1082.0523	753.1992	0.0000	0.0000	0.0000	0.0000	923.9051	1340.3604	1768.1198 (98a)
Space heating requirement - total per year (kWh/year)												10591.3481
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1762.8184	1510.3162	1450.5767	1082.0523	753.1992	0.0000	0.0000	0.0000	0.0000	923.9051	1340.3604	1768.1198 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10591.3481
Space heating per m2										(98c) / (4) =		292.9834 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1762.8184	1510.3162	1450.5767	1082.0523	753.1992	0.0000	0.0000	0.0000	0.0000	923.9051	1340.3604	1768.1198 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	1762.8184	1510.3162	1450.5767	1082.0523	753.1992	0.0000	0.0000	0.0000	0.0000	923.9051	1340.3604	1768.1198 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	16.2460	13.0331	11.7349	8.5975	6.6409	5.4257	6.0581	7.8745	10.2282	13.4200	15.1579	16.6975 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												10591.3481 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												1737.7873 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												131.1145 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)

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Energy used
Total delivered energy for all uses

0.0000 (237)
12880.6817 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10591.3481	16.4900	1746.5133	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1737.7873	16.4900	286.5611	(247)
Energy for instantaneous electric shower(s)	420.4318	16.4900	69.3292	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.1145	16.4900	21.6208	(250)
Additional standing charges			0.0000	(251)
Total energy cost			2124.0244	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	9.4227	(257)
SAP value		-8.5879	
SAP rating (Section 12)		1	(258)
SAP band		G	

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	10591.3481	0.1531	1621.3330	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1737.7873	0.1399	243.1456	(264)
Energy for instantaneous electric shower(s)	420.4318	0.1391	58.4914	(264a)
Space and water heating			1864.4787	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.1145	0.1443	18.9239	(268)
Total CO2, kg/year			1941.8939	(272)
CO2 emissions per m2			53.7200	(273)
EI value			67.9342	
EI rating			68	(274)
EI band			D	

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

1. Overall dwelling characteristics

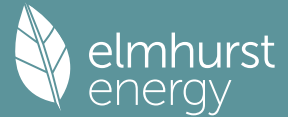
	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Basement floor	12.3500 (1a)	x	2.0000 (2a)	=	24.7000 (1a) - (3a)	
Ground floor	11.9000 (1b)	x	2.3600 (2b)	=	28.0840 (1b) - (3b)	
First floor	11.9000 (1c)	x	2.6000 (2c)	=	30.9400 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500				(4)	
Dwelling volume				$(3a) + (3b) + (3c) + (3d) + (3e) \dots (3n) =$	83.7240 (5)	

2. Ventilation rate

		m3 per hour	
Number of open chimneys	$0 * 80 =$	0.0000 (6a)	
Number of open flues	$0 * 20 =$	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	$0 * 10 =$	0.0000 (6c)	
Number of flues attached to solid fuel boiler	$0 * 20 =$	0.0000 (6d)	
Number of flues attached to other heater	$0 * 35 =$	0.0000 (6e)	
Number of blocked chimneys	$0 * 20 =$	0.0000 (6f)	
Number of intermittent extract fans	$2 * 10 =$	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	$= (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) =$	20.0000 / (5) =	0.2389 (8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.9889	(18)
Number of sides sheltered		2	(19)
Shelter factor	$(20) = 1 - [0.075 \times (19)] =$	0.8500	(20)
Infiltration rate adjusted to include shelter factor	$(21) = (18) \times (20) =$	0.8405	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infilt rate	1.0087	0.9456	0.9246	0.8195	0.8195	0.7565	0.7775	0.7355	0.7775	0.8405	0.8616	0.9246	(22b)
Effective ac	1.0087	0.9471	0.9274	0.8358	0.8358	0.7861	0.8023	0.7705	0.8023	0.8533	0.8711	0.9274	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Door			0.5100	1.6000	0.8160			(26)
Window			5.1300	1.3258	6.8011			(27)
Heatloss Floor 1			12.3500	0.6700	8.2745	110.0000	1358.5000	(28)
Basement wall	29.9700	1.9400	28.0300	2.1000	58.8630	110.0000	3083.3000	(29a)
GF wall	32.5700	1.6000	30.9700	2.1000	65.0370	190.0000	5884.3000	(29a)
FF Wall	33.8800	2.1000	31.7800	2.5000	79.4500	9.0000	286.0200	(29a)
joists	9.1700		9.1700	2.3000	21.0910	9.0000	82.5300	(30)
External Roof 2	3.5900		3.5900	2.3000	8.2570	9.0000	32.3100	(30)
Total net area of external elements Aum(A, m2)			121.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		248.5896			(33)
Main dwelling								
Internal Wall 1			10.0000			9.0000	90.0000	(32c)
Internal Floor 1			11.9000			18.0000	214.2000	(32d)
Internal Floor 2			11.9000			18.0000	214.2000	(32d)
Internal Ceiling 1			11.9000			9.0000	107.1000	(32e)
Internal Ceiling 2			11.9000			9.0000	107.1000	(32e)
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) = 11459.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								317.0003 (35)
Thermal bridges (Default value 0.200 * total exposed area)								24.3060 (36)
Point Thermal bridges								0.0000 (36a) =
Total fabric heat loss								(33) + (36) + (36a) = 272.8956 (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	27.8681	26.1672	25.6243	23.0928	23.0928	21.7202	22.1655	21.2871	22.1655	23.5747	24.0688	25.6243	(38)
Heat transfer coeff	300.7638	299.0629	298.5199	295.9884	295.9884	294.6159	295.0612	294.1828	295.0612	296.4703	296.9644	298.5199	(39)
Average = Sum(39)m / 12 =												296.7666	
HLP	8.3199	8.2728	8.2578	8.1878	8.1878	8.1498	8.1621	8.1378	8.1621	8.2011	8.2148	8.2578	(40)
HLP (average)												8.2093	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

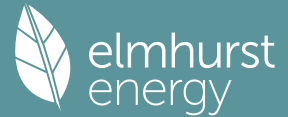
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3082 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	19.9707	19.6741	19.2565	18.4864	17.9097	17.2703	16.9250	17.3397	17.7913	18.4755	19.2614	19.9032	(42b)
Hot water usage for other uses	28.0272	27.0080	25.9889	24.9697	23.9505	22.9313	22.9313	23.9505	24.9697	25.9889	27.0080	28.0272	(42c)
Average daily hot water use (litres/day)												43.9953	(43)
Daily hot water use	47.9979	46.6822	45.2453	43.4561	41.8602	40.2017	39.8563	41.2902	42.7610	44.4643	46.2694	47.9304	(44)
Energy conte	76.0170	66.4748	69.5404	59.4892	56.3519	49.4326	48.2027	51.1259	52.7285	60.3377	65.9193	75.0474	(45)
Energy content (annual)										Total = Sum(45)m =		730.6675	
Distribution loss (46)m = 0.15 x (45)m	11.4025	9.9712	10.4311	8.9234	8.4528	7.4149	7.2304	7.6689	7.9093	9.0506	9.8879	11.2571	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0330	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												2.7592	(55)
Total storage loss	85.5362	77.2585	85.5362	82.7770	85.5362	82.7770	85.5362	85.5362	82.7770	85.5362	82.7770	85.5362	(56)
If cylinder contains dedicated solar storage	85.5362	77.2585	85.5362	82.7770	85.5362	82.7770	85.5362	85.5362	82.7770	85.5362	82.7770	85.5362	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837	(64)
								Total per year (kWh/year) = Sum(64)m =				1737.7873	(64)
Electric shower(s)	36.9612	32.9328	35.9613	34.3174	34.9614	33.3498	34.4614	34.9614	34.3174	35.9613	35.2851	36.9612	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				420.4318	(64a)
Heat gains from water heating, kWh/month	102.9449	92.1429	100.5415	94.5811	95.9063	90.9954	93.0717	94.1687	92.3332	97.4816	96.9610	102.6225	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5606	16.4854	13.4068	10.1498	7.5871	6.4054	6.9212	8.9964	12.0750	15.3320	17.8947	19.0765	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)													

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Total internal gains	138.3668	137.1174	135.1364	131.3626	128.9064	126.3825	125.0964	126.5708	128.2405	131.0236	134.6681	137.9335 (72)
	394.3931	392.8028	383.3725	367.0370	350.2725	335.5276	327.3826	329.1978	338.3168	353.6616	371.6144	387.1008 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	2.1000		12.7054		0.6300		0.7000		0.7700		8.1542 (74)	
East	1.0900		23.7288		0.6300		0.7000		0.7700		7.9045 (76)	
West	1.9400		23.7288		0.6300		0.7000		0.7700		14.0686 (80)	
Solar gains	30.1272	52.2098	86.5242	136.4764	165.0677	182.9365	171.1797	145.1774	108.7004	66.3640	37.8552	24.0273 (83)
Total gains	424.5203	445.0126	469.8967	503.5134	515.3402	518.4642	498.5623	474.3752	447.0172	420.0256	409.4696	411.1281 (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	10.5838	10.6440	10.6633	10.7545	10.7545	10.8046	10.7883	10.8205	10.7883	10.7370	10.7192	10.6633
alpha	1.7056	1.7096	1.7109	1.7170	1.7170	1.7203	1.7192	1.7214	1.7192	1.7158	1.7146	1.7109
util living area	0.9855	0.9837	0.9786	0.9678	0.9461	0.9022	0.8342	0.8383	0.9282	0.9662	0.9806	0.9859 (86)
MIT	15.9148	16.0882	16.7080	17.5876	18.6615	19.6126	20.2422	20.2575	19.4107	18.2520	16.9966	15.9849 (87)
Th 2	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000 (88)
util rest of house	0.9797	0.9771	0.9686	0.9488	0.8983	0.7476	0.3140	0.2803	0.8188	0.9390	0.9706	0.9803 (89)
MIT 2	12.9882	13.1983	13.9631	15.0415	16.3519	17.4488	17.9702	17.9794	17.2447	15.8639	14.3184	13.0698 (90)
Living area fraction	13.7751	13.9754	14.7011	15.7261	16.9729	18.0306	18.5811	18.5920	17.8271	16.5060	15.0385	13.8536 (92)
MIT	13.7751	13.9754	14.7011	15.7261	16.9729	18.0306	18.5811	18.5920	17.8271	16.5060	15.0385	13.8536 (93)
Temperature adjustment												0.0000
adjusted MIT	13.7751	13.9754	14.7011	15.7261	16.9729	18.0306	18.5811	18.5920	17.8271	16.5060	15.0385	13.8536 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9626	0.9583	0.9456	0.9193	0.8651	0.7507	0.5163	0.5063	0.8055	0.9100	0.9492	0.9635 (94)
Useful gains	408.6227	426.4345	444.3484	462.8772	445.8382	389.2203	257.4305	240.1612	360.0944	382.2326	388.6622	396.1289 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	2639.2234	2564.5760	2269.0925	1842.8605	1294.3212	775.0251	348.4982	321.2393	834.1591	1424.8464	2060.4895	2583.2638 (97)
Space heating kWh	1659.5669	1436.8310	1357.6096	993.5880	631.2713	0.0000	0.0000	0.0000	0.0000	775.7047	1203.7157	1627.2284 (98a)
Space heating requirement - total per year (kWh/year)												9685.5157
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1659.5669	1436.8310	1357.6096	993.5880	631.2713	0.0000	0.0000	0.0000	0.0000	775.7047	1203.7157	1627.2284 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9685.5157
Space heating per m2										(98c) / (4) =		267.9257 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1659.5669	1436.8310	1357.6096	993.5880	631.2713	0.0000	0.0000	0.0000	0.0000	775.7047	1203.7157	1627.2284 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	1659.5669	1436.8310	1357.6096	993.5880	631.2713	0.0000	0.0000	0.0000	0.0000	775.7047	1203.7157	1627.2284 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837 (64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	161.5532	143.7333	155.0766	142.2661	141.8881	132.2096	133.7389	136.6621	135.5055	145.8739	148.6963	160.5837 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	16.2460	13.0331	11.7349	8.5975	6.6409	5.4257	6.0581	7.8745	10.2282	13.4200	15.1579	16.6975 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											9685.5157	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											100.0000	
Water heating fuel used											1737.7873	(219)
Space cooling fuel											0.0000	(221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year											0.0000	(231)
Electricity for lighting (calculated in Appendix L)											131.1145	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											0.0000	(233)
Wind generation											0.0000	(234)
Hydro-electric generation (Appendix N)											0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)											0.0000	(235)
Appendix Q - special features												
Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy for all uses											11974.8493	(238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9685.5157	27.6700	2679.9822	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1737.7873	27.6700	480.8458	(247)
Energy for instantaneous electric shower(s)	420.4318	27.6700	116.3335	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	131.1145	27.6700	36.2794	(250)
Additional standing charges			0.0000	(251)
Total energy cost			3313.4408	(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	9685.5157	0.1534	1486.0227	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1737.7873	0.1399	243.1456	(264)
Energy for instantaneous electric shower(s)	420.4318	0.1391	58.4914	(264a)
Space and water heating			1729.1683	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	131.1145	0.1443	18.9239	(268)
Total CO2, kg/year			1806.5835	(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	9685.5157	1.5680	15187.2433	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1737.7873	1.5173	2636.7666	(278)
Energy for instantaneous electric shower(s)	420.4318	1.5143	636.6743	(278a)
Space and water heating			17824.0098	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	131.1145	1.5338	201.1077	(282)
Total Primary energy kWh/year			18661.7918	(286)

SAP 10 EPC IMPROVEMENTS

Exsiting

Current energy efficiency rating:	G 1
Current environmental impact rating:	D 68

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.9	-£ 216	-101 kg (5.6%)
U Solar photovoltaic panels	+ 4.2	-£ 273	-136 kg (8.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£216	2.80 kg/m²	G 1 C 69
Solar photovoltaic panels	£273	3.75 kg/m²	G 1 C 72
Total Savings	£489	6.55 kg/m²	

Potential energy efficiency rating:	G 1
Potential environmental impact rating:	C 72

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Fuel prices for cost data on this page from database revision number 593 TEST (31 Mar 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £3313	Potential £3097	Saving £216
Electricity			
Space heating	£2680	£2723	-£43
Water heating	£597	£338	£259
Lighting	£36	£36	£0
Generated (PV)	-£0	-£273	£273
Total cost of fuels	£3313	£2824	£489
Total cost of uses	£3313	£2824	£489
Delivered energy	331 kWh/m ²	282 kWh/m ²	49 kWh/m ²
Carbon dioxide emissions	1.8 tonnes	1.6 tonnes	0.2 tonnes
CO2 emissions per m ²	50 kg/m ²	43 kg/m ²	7 kg/m ²
Primary energy	516 kWh/m ²	443 kWh/m ²	73 kWh/m ²

SAP 10 WORKSHEET FOR Conversion (As Built) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Basement floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
Ground floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
First floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 83.7240 (5)
Dwelling volume			

2. Ventilation rate

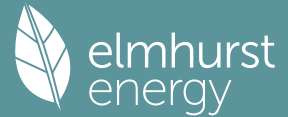
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2389 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9889 (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) = 0.8405 (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	1.0717	1.0507	1.0297	0.9246	0.9036	0.7985	0.7985	0.7775	0.8405	0.9036	0.9456	0.9876 (22b)
Effective ac	1.0717	1.0507	1.0297	0.9274	0.9082	0.8188	0.8188	0.8023	0.8533	0.9082	0.9471	0.9877 (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
Main dwelling							
Door			0.5100	1.6000	0.8160		(26)
Window			5.1300	1.3258	6.8011		(27)
Heatloss Floor 1			12.3500	0.6700	8.2745	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	2.1000	58.8630	110.0000	3083.3000 (29a)
GF wall	32.5700	1.6000	30.9700	2.1000	65.0370	190.0000	5884.3000 (29a)
FF Wall	33.8800	2.1000	31.7800	2.5000	79.4500	9.0000	286.0200 (29a)
joists	9.1700		9.1700	2.3000	21.0910	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	2.3000	8.2570	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m ²)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	248.5896		(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11459.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.0003 (35)
Thermal bridges (Default value 0.200 * total exposed area)							24.3060 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	272.8956 (37)

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Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6099	29.0293	28.4487	25.6243	25.0936	22.6230	22.6230	22.1655	23.5747	25.0936	26.1672	27.2896	(38)
Heat transfer coeff	302.5055	301.9249	301.3443	298.5199	297.9892	295.5187	295.5187	295.0612	296.4703	297.9892	299.0629	300.1853	(39)
Average = Sum(39)m / 12 =												298.5075	
HLP	8.3681	8.3520	8.3359	8.2578	8.2431	8.1748	8.1748	8.1621	8.2011	8.2431	8.2728	8.3039	(40)
HLP (average)												8.2575	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3082	(42)
Hot water usage for mixer showers													0.0000	(42a)
Hot water usage for baths	19.9707	19.6741	19.2565	18.4864	17.9097	17.2703	16.9250	17.3397	17.7913	18.4755	19.2614	19.9032	(42b)	
Hot water usage for other uses	28.0272	27.0080	25.9889	24.9697	23.9505	22.9313	22.9313	23.9505	24.9697	25.9889	27.0080	28.0272	(42c)	
Average daily hot water use (litres/day)													43.9953	(43)
Daily hot water use	47.9979	46.6822	45.2453	43.4561	41.8602	40.2017	39.8563	41.2902	42.7610	44.4643	46.2694	47.9304	(44)	
Energy content (annual)	76.0170	66.4748	69.5404	59.4892	56.3519	49.4326	48.2027	51.1259	52.7285	60.3377	65.9193	75.0474	(45)	
Distribution loss (46)m = 0.15 x (45)m	11.4025	9.9712	10.4311	8.9234	8.4528	7.4149	7.2304	7.6689	7.9093	9.0506	9.8879	11.2571	(46)	
Water storage loss (or HIU loss):														
Store volume													190.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0330	(51)
Volume factor from Table 2a													0.8580	(52)
Temperature factor from Table 2b													0.6000	(53)
Enter (49) or (54) in (55)													3.2302	(55)
Total storage loss	100.1363	90.4457	100.1363	96.9061	100.1363	96.9061	100.1363	100.1363	96.9061	100.1363	96.9061	100.1363	(56)	
If cylinder contains dedicated solar storage	60.6088	54.7434	60.6088	58.6537	60.6088	58.6537	60.6088	60.6088	58.6537	60.6088	58.6537	60.6088	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	136.6258	121.2182	130.1492	118.1429	116.9607	108.0863	108.8115	111.7347	111.3822	120.9465	124.5730	135.6563	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000	(H1)
Zero-loss collector efficiency													0.8000	(H2)
Collector linear heat loss coefficient													1.8000	(H3)
Collector 2nd order heat loss coefficient													0.0000	(H4)
Collector loop efficiency													0.9000	(H5)
Incidence angle modifier													1.0000	(H6)
Overshading factor													0.8000	(H8)
Overall heat loss coefficient of system													6.5000	(H10)
Heat loss coefficient of collector loop													3.9667	(H11)
Dedicated solar storage volume													75.0000	(H12)
If combined cylinder, total volume of cylinder													190.0000	(H13)
Effective solar volume													109.5000	(H14)
Reference volume													225.0000	(H15)
Storage tank correction coefficient													1.1973	(H16)
Heat delivered to hot water													558.8463	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													558.8463	
Solar input	-0.0000	-19.3904	-55.1877	-71.0336	-88.1311	-81.6179	-81.5758	-73.7262	-54.2017	-31.1833	-2.7986	-0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	136.6258	101.8278	74.9615	47.1093	28.8297	26.4685	27.2358	38.0086	57.1805	89.7631	121.7744	135.6563	(64)	
Electric shower(s)	36.9612	32.9328	35.9613	34.3174	34.9614	33.3498	34.4614	34.9614	34.3174	35.9613	35.2851	36.9612	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													420.4318	(64a)
Heat gains from water heating, kWh/month	83.0030	74.1308	80.5996	75.2825	75.9644	71.6967	73.1298	74.2268	73.0346	77.5396	77.6624	82.6806	(65)	

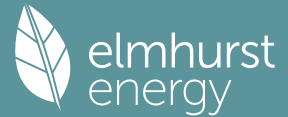
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5606	16.4854	13.4068	10.1498	7.5871	6.4054	6.9212	8.9964	12.0750	15.3320	17.8947	19.0765	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)	111.5632	110.3137	108.3327	104.5590	102.1027	99.5788	98.2928	99.7672	101.4369	104.2200	107.8644	111.1299	(72)
Total internal gains	367.5894	365.9991	356.5689	340.2334	323.4688	308.7240	300.5789	302.3941	311.5131	326.8580	344.8107	360.2971	(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
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North	2.1000	10.6334	0.6300	0.7000	0.7700	6.8244 (74)
East	1.0900	19.6403	0.6300	0.7000	0.7700	6.5425 (76)
West	1.9400	19.6403	0.6300	0.7000	0.7700	11.6445 (80)

Solar gains	25.0114	48.6194	80.7525	121.0484	152.6763	158.5380	149.9894	125.6941	94.7890	57.7404	31.0958	20.6453 (83)
Total gains	392.6008	414.6186	437.3214	461.2818	476.1451	467.2620	450.5683	428.0882	406.3022	384.5984	375.9066	380.9424 (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	10.5228	10.5431	10.5634	10.6633	10.6823	10.7716	10.7716	10.7883	10.7370	10.6823	10.6440	10.6042	
alpha	1.7015	1.7029	1.7042	1.7109	1.7122	1.7181	1.7181	1.7192	1.7158	1.7122	1.7096	1.7069	
util living area	0.9880	0.9862	0.9822	0.9741	0.9591	0.9303	0.8879	0.9016	0.9493	0.9753	0.9850	0.9887 (86)	
MIT	15.6235	15.8610	16.4461	17.3209	18.3042	19.2939	19.9456	19.8611	19.0600	17.8275	16.6005	15.5922 (87)	
Th 2	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000 (88)	
util rest of house	0.9836	0.9807	0.9742	0.9597	0.9270	0.8360	0.6049	0.6628	0.8855	0.9581	0.9779	0.9845 (89)	
MIT 2	12.6324	12.9245	13.6465	14.7202	15.9260	17.1075	17.7948	17.7259	16.8453	15.3473	13.8339	12.5881 (90)	
Living area fraction	fLA = Living area / (4) =												0.2689 (91)
MIT	13.4366	13.7140	14.3993	15.4195	16.5655	17.6954	18.3731	18.3000	17.4408	16.0142	14.5778	13.3958 (92)	
Temperature adjustment													0.0000
adjusted MIT	13.4366	13.7140	14.3993	15.4195	16.5655	17.6954	18.3731	18.3000	17.4408	16.0142	14.5778	13.3958 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9688	0.9642	0.9541	0.9337	0.8951	0.8161	0.6788	0.7139	0.8597	0.9332	0.9602	0.9705 (94)
Useful gains	380.3689	399.7586	417.2278	430.6861	426.1875	381.3457	305.8447	305.6222	349.2856	358.9226	360.9571	369.7162 (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	2763.8827	2661.1726	2380.3970	1946.1870	1449.8539	914.7401	523.9935	560.6301	990.4458	1613.3653	2236.3258	2760.4554 (97)
Space heating kWh	1773.3343	1519.6702	1460.5979	1091.1606	761.6078	0.0000	0.0000	0.0000	0.0000	933.3054	1350.2655	1778.7100 (98a)
Space heating requirement - total per year (kWh/year)												10668.6517
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1773.3343	1519.6702	1460.5979	1091.1606	761.6078	0.0000	0.0000	0.0000	0.0000	933.3054	1350.2655	1778.7100 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10668.6517
Space heating per m2												(98c) / (4) = 295.1218 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1773.3343	1519.6702	1460.5979	1091.1606	761.6078	0.0000	0.0000	0.0000	0.0000	933.3054	1350.2655	1778.7100 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	1773.3343	1519.6702	1460.5979	1091.1606	761.6078	0.0000	0.0000	0.0000	0.0000	933.3054	1350.2655	1778.7100 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating	136.6258	101.8278	74.9615	47.1093	28.8297	26.4685	27.2358	38.0086	57.1805	89.7631	121.7744	135.6563 (64)
Water heating requirement	136.6258	101.8278	74.9615	47.1093	28.8297	26.4685	27.2358	38.0086	57.1805	89.7631	121.7744	135.6563 (216)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (217)
Fuel for water heating, kWh/month	136.6258	101.8278	74.9615	47.1093	28.8297	26.4685	27.2358	38.0086	57.1805	89.7631	121.7744	135.6563 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	16.2460	13.0331	11.7349	8.5975	6.6409	5.4257	6.0581	7.8745	10.2282	13.4200	15.1579	16.6975 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-43.0276	-67.4806	-106.8442	-130.0463	-142.7998	-72.3718	-72.1909	-70.4621	-65.2842	-79.2351	-49.2336	-36.4850 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												10668.6517 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												885.4411 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	131.1145 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-935.4612 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	11250.1778 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	10668.6517	16.4900	1759.2607 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	885.4411	16.4900	146.0092 (247)
Energy for instantaneous electric shower(s)	420.4318	16.4900	69.3292 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	131.1145	16.4900	21.6208 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-935.4612	16.4900	-154.2576
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-154.2576 (252)
Total energy cost			1855.1543 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	8.2299 (257)
SAP value		-1.5050
SAP rating (Section 12)		1 (258)
SAP band		G

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	10668.6517	0.1531	1632.9897 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	885.4411	0.1476	130.7138 (264)
Energy for instantaneous electric shower(s)	420.4318	0.1391	58.4914 (264a)
Space and water heating			1763.7035 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	131.1145	0.1443	18.9239 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-935.4612	0.1372	-128.3153
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-128.3153 (269)
Total CO2, kg/year			1723.9004 (272)
CO2 emissions per m2			47.6900 (273)
EI value			71.5339
EI rating			72 (274)
EI band			C

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

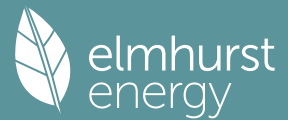
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	83.7240 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)

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

0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
2 * 10 = 20.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

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

Air changes per hour
20.0000 / (5) = 0.2389 (8)
No
Blower Door
15.0000 (17)
0.9889 (18)
2 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 0.8500 (20)
(21) = (18) x (20) = 0.8405 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000	(22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000	(22a)
Adj infilt rate	1.0087	0.9456	0.9246	0.8195	0.8195	0.7565	0.7775	0.7355	0.7775	0.8405	0.8616	0.9246	(22b)
Effective ac	1.0087	0.9471	0.9274	0.8358	0.8358	0.7861	0.8023	0.7705	0.8023	0.8533	0.8711	0.9274	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Door			0.5100	1.6000	0.8160		(26)
Window			5.1300	1.3258	6.8011		(27)
Heatloss Floor 1			12.3500	0.6700	8.2745	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	2.1000	58.8630	110.0000	3083.3000 (29a)
GF wall	32.5700	1.6000	30.9700	2.1000	65.0370	190.0000	5884.3000 (29a)
FF Wall	33.8800	2.1000	31.7800	2.5000	79.4500	9.0000	286.0200 (29a)
joists	9.1700		9.1700	2.3000	21.0910	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	2.3000	8.2570	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m2)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	248.5896	(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
Thermal bridges (Default value 0.200 * total exposed area)
Point Thermal bridges
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11459.5600 (34)
317.0003 (35)
24.3060 (36)
(33a) = 0.0000
(33) + (36) + (36a) = 272.8956 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	27.8681	26.1672	25.6243	23.0928	23.0928	21.7202	22.1655	21.2871	22.1655	23.5747	24.0688	25.6243	(38)
Heat transfer coeff	300.7638	299.0629	298.5199	295.9884	295.9884	294.6159	295.0612	294.1828	295.0612	296.4703	296.9644	298.5199	(39)
Average = Sum(39)m / 12 =												296.7666	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	8.3199	8.2728	8.2578	8.1878	8.1878	8.1498	8.1621	8.1378	8.1621	8.2011	8.2148	8.2578	(40)
HLP (average)												8.2093	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3082 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

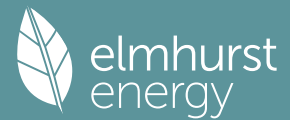
Hot water usage for baths 19.9707 19.6741 19.2565 18.4864 17.9097 17.2703 16.9250 17.3397 17.7913 18.4755 19.2614 19.9032 (42b)

Hot water usage for other uses 28.0272 27.0080 25.9889 24.9697 23.9505 22.9313 22.9313 23.9505 24.9697 25.9889 27.0080 28.0272 (42c)

Average daily hot water use (litres/day) 43.9953 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	47.9979	46.6822	45.2453	43.4561	41.8602	40.2017	39.8563	41.2902	42.7610	44.4643	46.2694	47.9304	(44)
Energy conte	76.0170	66.4748	69.5404	59.4892	56.3519	49.4326	48.2027	51.1259	52.7285	60.3377	65.9193	75.0474	(45)
Energy content (annual)										Total = Sum(45)m =		730.6675	
Distribution loss (46)m = 0.15 x (45)m													
	11.4025	9.9712	10.4311	8.9234	8.4528	7.4149	7.2304	7.6689	7.9093	9.0506	9.8879	11.2571	(46)
Water storage loss (or HIU loss):													
Store volume												190.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0330	(51)
Volume factor from Table 2a												0.8580	(52)
Temperature factor from Table 2b												0.6000	(53)
Enter (49) or (54) in (55)												3.2302	(55)
Total storage loss	100.1363	90.4457	100.1363	96.9061	100.1363	96.9061	100.1363	100.1363	96.9061	100.1363	96.9061	100.1363	(56)
If cylinder contains dedicated solar storage	60.6088	54.7434	60.6088	58.6537	60.6088	58.6537	60.6088	60.6088	58.6537	60.6088	58.6537	60.6088	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	136.6258	121.2182	130.1492	118.1429	116.9607	108.0863	108.8115	111.7347	111.3822	120.9465	124.5730	135.6563	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)

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Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
If combined cylinder, total volume of cylinder													190.0000 (H13)
Effective solar volume													109.5000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.1973 (H16)
Heat delivered to hot water													642.8007 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													642.8007
Solar input	-5.7357	-22.5662	-59.7024	-79.6513	-93.9337	-91.4533	-90.6412	-84.2331	-63.4807	-39.9569	-11.4462		-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000 (63d)
Output from w/h	130.8901	98.6521	70.4468	38.4916	23.0271	16.6330	18.1704	27.5016	47.9015	80.9896	113.1268		135.6563 (64)
													801.4867 (64)
Electric shower(s)													
	36.9612	32.9328	35.9613	34.3174	34.9614	33.3498	34.4614	34.9614	34.3174	35.9613	35.2851		36.9612 (64a)
													420.4318 (64a)
Heat gains from water heating, kWh/month													
	83.0030	74.1308	80.5996	75.2825	75.9644	71.6967	73.1298	74.2268	73.0346	77.5396	77.6624		82.6806 (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	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.5606	16.4854	13.4068	10.1498	7.5871	6.4054	6.9212	8.9964	12.0750	15.3320	17.8947	19.0765	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)													
	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)													
	111.5632	110.3137	108.3327	104.5590	102.1027	99.5788	98.2928	99.7672	101.4369	104.2200	107.8644	111.1299	(72)
Total internal gains													
	367.5894	365.9991	356.5689	340.2334	323.4688	308.7240	300.5789	302.3941	311.5131	326.8580	344.8107	360.2971	(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				2.1000	12.7054		0.6300		0.7000	0.7700		8.1542 (74)
East				1.0900	23.7288		0.6300		0.7000	0.7700		7.9045 (76)
West				1.9400	23.7288		0.6300		0.7000	0.7700		14.0686 (80)
Solar gains	30.1272	52.2098	86.5242	136.4764	165.0677	182.9365	171.1797	145.1774	108.7004	66.3640	37.8552	24.0273 (83)
Total gains	397.7166	418.2089	443.0931	476.7098	488.5365	491.6605	471.7587	447.5715	420.2136	393.2219	382.6659	384.3244 (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	10.5838	10.6440	10.6633	10.7545	10.7545	10.8046	10.7883	10.8205	10.7883	10.7370	10.7192	10.6633	
alpha	1.7056	1.7096	1.7109	1.7170	1.7170	1.7203	1.7192	1.7214	1.7192	1.7158	1.7146	1.7109	
util living area	0.9869	0.9852	0.9805	0.9704	0.9502	0.9092	0.8453	0.8497	0.9343	0.9695	0.9826	0.9874 (86)	
MIT	15.8849	16.0584	16.6785	17.5587	18.6342	19.5882	20.2221	20.2371	19.3846	18.2232	16.9669	15.9548 (87)	
Th 2	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000 (88)	
util rest of house	0.9817	0.9792	0.9714	0.9529	0.9055	0.7616	0.3285	0.2945	0.8319	0.9447	0.9735	0.9823 (89)	
MIT 2	12.9516	13.1619	13.9274	15.0074	16.3221	17.4297	17.9679	17.9777	17.2207	15.8307	14.2823	13.0330 (90)	
Living area fraction													
MIT	13.7403	13.9407	14.6671	15.6934	16.9437	18.0101	18.5740	18.5852	17.8026	16.4740	15.0042	13.8186 (92)	
Temperature adjustment												0.0000	
adjusted MIT	13.7403	13.9407	14.6671	15.6934	16.9437	18.0101	18.5740	18.5852	17.8026	16.4740	15.0042	13.8186 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9659	0.9618	0.9499	0.9248	0.8731	0.7626	0.5324	0.5232	0.8174	0.9172	0.9538	0.9669 (94)	
Useful gains	384.1623	402.2330	420.8777	440.8634	426.5519	374.9486	251.1564	234.1528	343.4968	360.6742	364.9754	371.6113 (95)	
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)	
Heat loss rate W	2628.7730	2554.2089	2258.9328	1833.1797	1285.6961	768.9726	346.4108	319.2549	826.9283	1415.3460	2050.2893	2572.8211 (97)	
Space heating kWh	1669.9904	1446.1278	1367.5130	1002.4677	639.2033	0.0000	0.0000	0.0000	0.0000	784.6758	1213.4260	1637.7001 (98a)	
Space heating requirement - total per year (kWh/year)												9761.1042	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1669.9904	1446.1278	1367.5130	1002.4677	639.2033	0.0000	0.0000	0.0000	0.0000	784.6758	1213.4260	1637.7001 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												9761.1042	
Space heating per m2												270.0167 (99)	

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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 %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1669.9904	1446.1278	1367.5130	1002.4677	639.2033	0.0000	0.0000	0.0000	0.0000	784.6758	1213.4260	1637.7001	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1669.9904	1446.1278	1367.5130	1002.4677	639.2033	0.0000	0.0000	0.0000	0.0000	784.6758	1213.4260	1637.7001	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	130.8901	98.6521	70.4468	38.4916	23.0271	16.6330	18.1704	27.5016	47.9015	80.9896	113.1268	135.6563	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	130.8901	98.6521	70.4468	38.4916	23.0271	16.6330	18.1704	27.5016	47.9015	80.9896	113.1268	135.6563	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	16.2460	13.0331	11.7349	8.5975	6.6409	5.4257	6.0581	7.8745	10.2282	13.4200	15.1579	16.6975	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-50.1296	-70.5053	-110.7065	-139.1274	-144.1038	-73.4577	-73.2748	-72.3401	-68.2030	-85.7748	-57.3800	-41.2166	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												9761.1042	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												801.4867	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												131.1145	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-986.2196	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												10207.9176	(238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price £/kWh	Fuel cost £/year	
Space heating - main system 1	9761.1042	27.6700	2700.8975	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	801.4867	27.6700	221.7714	(247)
Energy for instantaneous electric shower(s)	420.4318	27.6700	116.3335	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	27.6700	22.1360	(249)
Energy for lighting	131.1145	27.6700	36.2794	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-986.2196	27.6700	-272.8870	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-272.8870	(252)
Total energy cost			2824.5308	(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	9761.1042	0.1534	1497.4345	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	801.4867	0.1492	119.5874	(264)
Energy for instantaneous electric shower(s)	420.4318	0.1391	58.4914	(264a)
Space and water heating			1617.0218	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	131.1145	0.1443	18.9239	(268)
Energy saving/generation technologies				

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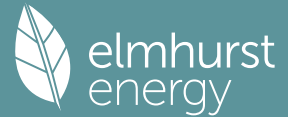


PV Unit electricity used in dwelling	-986.2196	0.1376	-135.7263
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-135.7263 (269)
Total CO2, kg/year			1569.8077 (272)

----- 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	9761.1042	1.5680	15305.0787 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	801.4867	1.5520	1243.9425 (278)
Energy for instantaneous electric shower(s)	420.4318	1.5143	636.6743 (278a)
Space and water heating			16549.0212 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	131.1145	1.5338	201.1077 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-986.2196	1.5089	-1488.0851
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1488.0851 (283)
Total Primary energy kWh/year			16019.7422 (286)

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Plot Reference	10278	Issued on Date	22/04/2026
Assessment Reference	Built	Plot Type Ref	
Plot Address		SAP Version	10.2
SAP Rating	60 D	DER	13.96
Environmental	92 A	% DER < TER	N/A
CO ₂ Emissions (t/year)	0.47	DFEE	110.13
Compliance Check	N/A	% DFEE < TFEE	
% DPER < TPER		DPER	145.97
Assessor Details	Mr. Harry Davey	Assessor ID	R434-0001
Client			

SAP 10 WORKSHEET FOR Conversion (As Built) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	83.7240 (5)

2. Ventilation rate

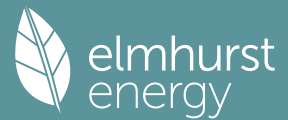
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2389 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.9889 (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) = 0.8405 (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	1.0717	1.0507	1.0297	0.9246	0.9036	0.7985	0.7985	0.7775	0.8405	0.9036	0.9456	0.9876 (22b)
Effective ac	1.0717	1.0507	1.0297	0.9274	0.9082	0.8188	0.8188	0.8023	0.8533	0.9082	0.9471	0.9877 (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
Main dwelling							
Door			0.5100	3.0000	1.5300		(26)
Window			5.1300	4.0268	20.6577		(27)
Heatloss Floor 1			12.3500	0.2200	2.7170	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	0.3300	9.2499	9.0000	252.2700 (29a)
GF wall	32.5700	1.6000	30.9700	0.3900	12.0783	9.0000	278.7300 (29a)
FF Wall	33.8800	2.1000	31.7800	0.3600	11.4408	9.0000	286.0200 (29a)
joists	9.1700		9.1700	0.2100	1.9257	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	0.3500	1.2565	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m ²)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559		(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3022.9600 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.6227 (35)
Thermal bridges (Default value 0.200 * total exposed area) 24.3060 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 85.1619 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	29.6099	29.0293	28.4487	25.6243	25.0936	22.6230	22.6230	22.1655	23.5747	25.0936	26.1672	27.2896
Heat transfer coeff	114.7718	114.1912	113.6106	110.7862	110.2555	107.7850	107.7850	107.3275	108.7366	110.2555	111.3291	112.4516
Average = Sum(39)m / 12 =												110.7738
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	3.1749	3.1588	3.1428	3.0646	3.0499	2.9816	2.9816	2.9689	3.0079	3.0499	3.0796	3.1107
HLP (average)												3.0643
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3082	(42)
Hot water usage for mixer showers														
63.4610	62.5073	61.1176	58.4586	56.4963	54.3081	53.0642	54.4434	55.9553	58.3049	61.0210	63.2179	63.2179	(42a)	
Hot water usage for baths														
21.0218	20.7096	20.2700	19.4593	18.8523	18.1793	17.8157	18.2523	18.7277	19.4479	20.2752	20.9508	20.9508	(42b)	
Hot water usage for other uses														
29.5023	28.4295	27.3567	26.2839	25.2111	24.1383	24.1383	25.2111	26.2839	27.3567	28.4295	29.5023	29.5023	(42c)	
Average daily hot water use (litres/day)													104.8198	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
113.9851	111.6464	108.7443	104.2018	100.5598	96.6256	95.0182	97.9068	100.9668	105.1094	109.7256	113.6709	113.6709	(44)	
Energy content (annual)														
180.5246	158.9830	167.1359	142.6471	135.3728	118.8124	114.9163	121.2291	124.5022	142.6325	156.3243	177.9812	177.9812	(45)	
Distribution loss (46)m = 0.15 x (45)m													1741.0614	
27.0787	23.8475	25.0704	21.3971	20.3059	17.8219	17.2374	18.1844	18.6753	21.3949	23.4486	26.6972	26.6972	(46)	
Water storage loss (or HIU loss):														
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9390	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0471	(55)
Total storage loss														
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	(56)	
If cylinder contains dedicated solar storage														
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	(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)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025	233.7025	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h														
236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025	233.7025	(64)	
Electric shower(s)														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)
Heat gains from water heating, kWh/month														
104.6014	93.1250	100.1497	90.5692	89.5885	82.6442	82.7867	84.8857	84.5360	92.0023	95.1169	103.7558	103.7558	(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	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6333	15.6618	12.7370	9.6427	7.2081	6.0853	6.5754	8.5470	11.4717	14.5660	17.0007	18.1234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)	140.5933	138.5788	134.6098	125.7906	120.4146	114.7836	111.2724	114.0937	117.4111	123.6590	132.1068	139.4567	(72)
Total internal gains	395.6923	393.4406	382.1761	360.9579	341.4017	323.6087	313.2128	316.2712	326.8841	345.5310	368.1590	387.6708	(73)

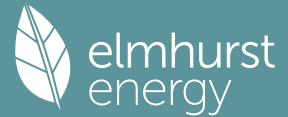
6. Solar gains

[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				2.1000	10.6334	0.8500		0.7000	0.7700		9.2075 (74)	
East				1.0900	19.6403	0.8500		0.7000	0.7700		8.8272 (76)	
West				1.9400	19.6403	0.8500		0.7000	0.7700		15.7108 (80)	
Solar gains	33.7455	65.5976	108.9518	163.3193	205.9918	213.9004	202.3666	169.5873	127.8899	77.9037	41.9547	27.8547 (83)
Total gains	429.4378	459.0383	491.1279	524.2772	547.3935	537.5092	515.5795	485.8584	454.7741	423.4348	410.1137	415.5256 (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)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	7.3164	7.3536	7.3911	7.5796	7.6160	7.7906	7.7906	7.8238	7.7224	7.6160	7.5426	7.4673
alpha	1.4878	1.4902	1.4927	1.5053	1.5077	1.5194	1.5194	1.5216	1.5148	1.5077	1.5028	1.4978
util living area	0.9141	0.9020	0.8788	0.8362	0.7718	0.6761	0.5777	0.6083	0.7424	0.8470	0.8964	0.9174 (86)
Living	15.9255	16.2393	16.9193	17.9108	18.9275	19.8578	20.3827	20.3042	19.5658	18.2912	16.9753	15.8968
Non living	14.4576	14.7678	15.4389	16.4193	17.3818	18.2207	18.6050	18.5687	17.9919	16.8086	15.5200	14.4457
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	18.4584	16.2383	16.9193	17.9108	18.9275	19.8578	20.3827	20.3042	19.5658	18.2912	16.9753	16.6298 (87)
Th 2	18.6651	18.6727	18.6803	18.7180	18.7252	18.7592	18.7592	18.7656	18.7460	18.7252	18.7107	18.6957 (88)
util rest of house	0.8964	0.8815	0.8513	0.7943	0.7010	0.5477	0.3659	0.4072	0.6337	0.7989	0.8711	0.9005 (89)
MIT 2	16.5577	14.7678	15.4389	16.4193	17.3818	18.2207	18.6050	18.5687	17.9919	16.8086	15.5200	15.0561 (90)
Living area fraction									fLA = Living area /			
MIT	17.0688	15.1632	15.8369	16.8203	17.7974	18.6609	19.0830	19.0354	18.4151	17.2073	15.9113	15.4792 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0688	15.1632	15.8369	16.8203	17.7974	18.6609	19.0830	19.0354	18.4151	17.2073	15.9113	15.4792 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8805	0.8334	0.8006	0.7442	0.6616	0.5404	0.4050	0.4387	0.6117	0.7515	0.8231	0.8653 (94)
Useful gains	378.1291	382.5462	393.2133	390.1775	362.1649	290.4553	208.8323	213.1465	278.2046	318.1945	337.5825	359.5616 (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	1465.4966	1171.9673	1060.7737	877.4622	672.2709	437.7007	267.6303	282.8472	469.2074	728.4881	980.9552	1268.3689 (97)
Space heating kWh	809.0015	530.4910	496.6650	350.8450	230.7189	0.0000	0.0000	0.0000	0.0000	305.2584	463.2283	676.1526 (98a)
Space heating requirement - total per year (kWh/year)												3862.3606
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	809.0015	530.4910	496.6650	350.8450	230.7189	0.0000	0.0000	0.0000	0.0000	305.2584	463.2283	676.1526 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3862.3606
Space heating per m2										(98c) / (4) =		106.8426 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												214.1339 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	809.0015	530.4910	496.6650	350.8450	230.7189	0.0000	0.0000	0.0000	0.0000	305.2584	463.2283	676.1526 (98)
Space heating efficiency (main heating system 1)	214.1339	214.1339	214.1339	214.1339	214.1339	0.0000	0.0000	0.0000	0.0000	214.1339	214.1339	214.1339 (210)
Space heating fuel (main heating system)	377.8017	247.7380	231.9413	163.8437	107.7451	0.0000	0.0000	0.0000	0.0000	142.5549	216.3265	315.7616 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025 (64)
Efficiency of water heater (217)m	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175 (216)
Fuel for water heating, kWh/month	142.3876	126.1542	134.3180	118.4751	115.1741	104.1097	102.8448	106.6496	107.5390	119.5496	126.7185	140.8546 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	15.4343	12.3820	11.1486	8.1680	6.3092	5.1546	5.7554	7.4811	9.7172	12.7496	14.4006	15.8633 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1803.7129 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												165.9175
Water heating fuel used												1444.7748 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												124.5640 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)

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Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3373.0517 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1803.7129	16.4900	297.4323 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1444.7748	16.4900	238.2434 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	124.5640	16.4900	20.5406 (250)
Additional standing charges			0.0000 (251)
Total energy cost			556.2162 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	2.4675 (257)
SAP value	60.0018
SAP rating (Section 12)	60 (258)
SAP band	D

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	1803.7129	0.1541	277.8807 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1444.7748	0.1408	203.4154 (264)
Space and water heating			481.2961 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	124.5640	0.1443	17.9784 (268)
Total CO2, kg/year			499.2746 (272)
CO2 emissions per m2			13.8100 (273)
EI value			91.7557
EI rating			92 (274)
EI band			A

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

1. Overall dwelling characteristics

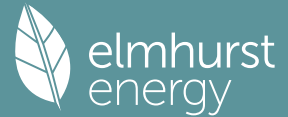
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	83.7240 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	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	Air changes per hour
Pressure Test	20.0000 / (5) = 0.2389 (8)
Pressure Test Method	No
Measured/design AP50	Blower Door
Infiltration rate	15.0000 (17)
Number of sides sheltered	0.9889 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8405 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate												

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Effective ac	1.0087	0.9456	0.9246	0.8195	0.8195	0.7565	0.7775	0.7355	0.7775	0.8405	0.8616	0.9246 (22b)
	1.0087	0.9471	0.9274	0.8358	0.8358	0.7861	0.8023	0.7705	0.8023	0.8533	0.8711	0.9274 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Door			0.5100	3.0000	1.5300		(26)
Window			5.1300	4.0268	20.6577		(27)
Heatloss Floor 1			12.3500	0.2200	2.7170	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	0.3300	9.2499	9.0000	252.2700 (29a)
GF wall	32.5700	1.6000	30.9700	0.3900	12.0783	9.0000	278.7300 (29a)
FF Wall	33.8800	2.1000	31.7800	0.3600	11.4408	9.0000	286.0200 (29a)
joists	9.1700		9.1700	0.2100	1.9257	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	0.3500	1.2565	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m2)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559		(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3022.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							83.6227 (35)
Thermal bridges (Default value 0.200 * total exposed area)							24.3060 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	85.1619 (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	27.8681	26.1672	25.6243	23.0928	23.0928	21.7202	22.1655	21.2871	22.1655	23.5747	24.0688	25.6243 (38)
Heat transfer coeff	113.0300	111.3291	110.7862	108.2547	108.2547	106.8821	107.3275	106.4490	107.3275	108.7366	109.2307	110.7862 (39)
Average = Sum(39)m / 12 =												109.0329
HLP	3.1267	3.0796	3.0646	2.9946	2.9946	2.9566	2.9689	2.9446	2.9689	3.0079	3.0216	3.0646 (40)
HLP (average)												3.0161
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

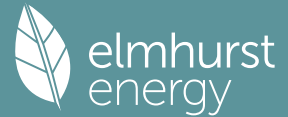
4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3082 (42)
Hot water usage for mixer showers												
63.4610	62.5073	61.1176	58.4586	56.4963	54.3081	53.0642	54.4434	55.9553	58.3049	61.0210	63.2179 (42a)	
Hot water usage for baths												
21.0218	20.7096	20.2700	19.4593	18.8523	18.1793	17.8157	18.2523	18.7277	19.4479	20.2752	20.9508 (42b)	
Hot water usage for other uses												
29.5023	28.4295	27.3567	26.2839	25.2111	24.1383	24.1383	25.2111	26.2839	27.3567	28.4295	29.5023 (42c)	
Average daily hot water use (litres/day)												104.8198 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
113.9851	111.6464	108.7443	104.2018	100.5598	96.6256	95.0182	97.9068	100.9668	105.1094	109.7256	113.6709 (44)	
Energy content (annual)	180.5246	158.9830	167.1359	142.6471	135.3728	118.8124	114.9163	121.2291	124.5022	142.6325	156.3243 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1741.0614
27.0787	23.8475	25.0704	21.3971	20.3059	17.8219	17.2374	18.1844	18.6753	21.3949	23.4486	26.6972 (46)	
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9390 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0471 (55)
Total storage loss												
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589 (56)	
If cylinder contains dedicated solar storage												
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589 (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 (59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)	
Total heat required for water heating calculated for each month												
236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025 (62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
Output from w/h												
236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025 (64)	
	Total per year (kWh/year) = Sum(64)m =										2397.1343 (64)	
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										0.0000 (64a)	
Heat gains from water heating, kWh/month												
104.6014	93.1250	100.1497	90.5692	89.5885	82.6442	82.7867	84.8857	84.5360	92.0023	95.1169	103.7558 (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	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	17.6333	15.6618	12.7370	9.6427	7.2081	6.0853	6.5754	8.5470	11.4717	14.5660	17.0007	18.1234 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573 (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)												
	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277 (71)
Water heating gains (Table 5)												

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Total internal gains	140.5933	138.5788	134.6098	125.7906	120.4146	114.7836	111.2724	114.0937	117.4111	123.6590	132.1068	139.4567 (72)
	395.6923	393.4406	382.1761	360.9579	341.4017	323.6087	313.2128	316.2712	326.8841	345.5310	368.1590	387.6708 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d	Gains W
North	2.1000				12.7054		0.8500		0.7000		0.7700	11.0016 (74)
East	1.0900				23.7288		0.8500		0.7000		0.7700	10.6648 (76)
West	1.9400				23.7288		0.8500		0.7000		0.7700	18.9814 (80)
Solar gains	40.6478	70.4418	116.7390	184.1348	222.7104	246.8191	230.9568	195.8743	146.6593	89.5387	51.0745	32.4178 (83)
Total gains	436.3401	463.8824	498.9151	545.0927	564.1120	570.4279	544.1696	512.1454	473.5434	435.0697	419.2335	420.0886 (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	7.4291	7.5426	7.5796	7.7568	7.7568	7.8564	7.8238	7.8884	7.8238	7.7224	7.6875	7.5796
alpha	1.4953	1.5028	1.5053	1.5171	1.5171	1.5238	1.5216	1.5259	1.5216	1.5148	1.5125	1.5053
util living area	0.9068	0.8954	0.8683	0.8165	0.7369	0.6182	0.4986	0.5066	0.6926	0.8196	0.8821	0.9088 (86)
Living	16.2384	16.4925	17.2100	18.2104	19.2785	20.1339	20.5960	20.6002	19.8906	18.7248	17.4011	16.3131
Non living	14.7780	15.0374	15.7419	16.7213	17.7123	18.4335	18.7126	18.7295	18.2696	17.2301	15.9515	14.8688
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	18.6144	16.4925	17.2100	18.2104	19.2785	20.1339	20.5960	20.6002	19.8906	18.7248	17.4011	16.9860 (87)
Th 2	18.6880	18.7107	18.7180	18.7527	18.7527	18.7718	18.7656	18.7779	18.7656	18.7460	18.7392	18.7180 (88)
util rest of house	0.8870	0.8731	0.8379	0.7690	0.6519	0.4634	0.2416	0.2389	0.5551	0.7584	0.8518	0.8892 (89)
MIT 2	16.7291	15.0374	15.7419	16.7213	17.7123	18.4335	18.7126	18.7295	18.2696	17.2301	15.9515	15.4215 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	17.2360	15.4287	16.1366	17.1217	18.1334	18.8907	19.2190	19.2325	18.7054	17.6320	16.3413	15.8421 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.2360	15.4287	16.1366	17.1217	18.1334	18.8907	19.2190	19.2325	18.7054	17.6320	16.3413	15.8421 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8708	0.8244	0.7870	0.7207	0.6207	0.4739	0.3065	0.3076	0.5502	0.7148	0.8029	0.8527 (94)
Useful gains	379.9524	382.4026	392.6234	392.8333	350.1521	270.2973	166.7699	157.5529	260.5269	310.9853	336.6094	358.2283 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	1383.0352	1116.4827	1001.1350	825.0837	599.0210	373.0892	195.2285	184.4259	397.6934	645.0263	900.2015	1179.0030 (97)
Space heating kWh	746.2936	493.3018	452.7327	311.2203	185.1585	0.0000	0.0000	0.0000	0.0000	248.5266	405.7864	610.6563 (98a)
Space heating requirement - total per year (kWh/year)	3453.6762											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	746.2936	493.3018	452.7327	311.2203	185.1585	0.0000	0.0000	0.0000	0.0000	248.5266	405.7864	610.6563 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3453.6762											
Space heating per m2	(98c) / (4) = 95.5374 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												213.5685 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	746.2936	493.3018	452.7327	311.2203	185.1585	0.0000	0.0000	0.0000	0.0000	248.5266	405.7864	610.6563 (98)
Space heating efficiency (main heating system 1)	213.5685	213.5685	213.5685	213.5685	213.5685	0.0000	0.0000	0.0000	0.0000	213.5685	213.5685	213.5685 (210)
Space heating fuel (main heating system)	349.4399	230.9806	211.9848	145.7239	86.6975	0.0000	0.0000	0.0000	0.0000	116.3685	190.0029	285.9300 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	236.2459	209.3119	222.8571	196.5709	191.0940	172.7362	170.6376	176.9503	178.4260	198.3537	210.2481	233.7025 (64)
Efficiency of water heater (217)m	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004 (216)
Fuel for water heating, kWh/month	142.1452	125.9395	134.0894	118.2734	114.9781	103.9325	102.6698	106.4680	107.3559	119.3461	126.5027	140.6148 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	15.4343	12.3820	11.1486	8.1680	6.3092	5.1546	5.7554	7.4811	9.7172	12.7496	14.4006	15.8633 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1617.1281	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												166.2004	
Water heating fuel used												1442.3154	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												124.5640	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												3184.0074	(238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1617.1281	27.6700	447.4593	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1442.3154	27.6700	399.0887	(247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	124.5640	27.6700	34.4669	(250)
Additional standing charges			0.0000	(251)
Total energy cost			881.0149	(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	1617.1281	0.1544	249.7550	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1442.3154	0.1408	203.0691	(264)
Space and water heating			452.8241	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	124.5640	0.1443	17.9784	(268)
Total CO2, kg/year			470.8026	(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	1617.1281	1.5717	2541.6981	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1442.3154	1.5206	2193.1841	(278)
Space and water heating			4734.8823	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	124.5640	1.5338	191.0604	(282)
Total Primary energy kWh/year			4925.9427	(286)

SAP 10 EPC IMPROVEMENTS

Built

Current energy efficiency rating:	D 60
Current environmental impact rating:	A 92

N Solar water heating	Recommended
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 3.8	-£ 105	-48 kg (10.1%)
U Solar photovoltaic panels	+ 9.0	-£ 219	-108 kg (25.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£105	1.32 kg/m²	D 64 A 92
Solar photovoltaic panels	£219	3.00 kg/m²	C 73 A 94
Total Savings	£324	4.31 kg/m²	

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Potential energy efficiency rating:
Potential environmental impact rating:

C 73
A 94

Fuel prices for cost data on this page from database revision number 593 TEST (31 Mar 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £881	Potential £776	Saving £105
Electricity			
Space heating	£447	£470	-£23
Water heating	£399	£271	£128
Lighting	£34	£34	£0
Generated (PV)	-£10	-£219	£219
Total cost of fuels	£881	£557	£324
Total cost of uses	£880	£556	£324
Delivered energy	88 kWh/m²	56 kWh/m²	32 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.3 tonnes	0.2 tonnes
CO2 emissions per m²	13 kg/m²	9 kg/m²	4 kg/m²
Primary energy	136 kWh/m²	88 kWh/m²	48 kWh/m²

SAP 10 WORKSHEET FOR Conversion (As Built) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	83.7240 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) =	0.2389 (8)
Pressure test	No	
Pressure Test Method	Blower Door	
Measured/design AP50	15.0000	(17)
Infiltration rate	0.9889	(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) =	0.8405 (21)

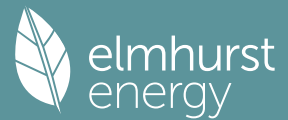
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	1.0717	1.0507	1.0297	0.9246	0.9036	0.7985	0.7985	0.7775	0.8405	0.9036	0.9456	0.9876 (22b)
Effective ac	1.0717	1.0507	1.0297	0.9274	0.9082	0.8188	0.8188	0.8023	0.8533	0.9082	0.9471	0.9877 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Door			0.5100	3.0000	1.5300		(26)
Window			5.1300	4.0268	20.6577		(27)
Heatloss Floor 1			12.3500	0.2200	2.7170	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	0.3300	9.2499	9.0000	252.2700 (29a)
CF wall	32.5700	1.6000	30.9700	0.3900	12.0783	9.0000	278.7300 (29a)
FF Wall	33.8800	2.1000	31.7800	0.3600	11.4408	9.0000	286.0200 (29a)
Joists	9.1700		9.1700	0.2100	1.9257	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	0.3500	1.2565	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m2)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.8559		(33)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3022.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 83.6227 (35)

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Thermal bridges (Default value 0.200 * total exposed area)
 Point Thermal bridges (36a) = 24.3060 (36)
 Total fabric heat loss (33) + (36) + (36a) = 85.1619 (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	29.6099	29.0293	28.4487	25.6243	25.0936	22.6230	22.6230	22.1655	23.5747	25.0936	26.1672	27.2896	(38)
Heat transfer coeff	114.7718	114.1912	113.6106	110.7862	110.2555	107.7850	107.7850	107.3275	108.7366	110.2555	111.3291	112.4516	(39)
Average = Sum(39)m / 12 =												110.7738	
HLP	3.1749	3.1588	3.1428	3.0646	3.0499	2.9816	2.9816	2.9689	3.0079	3.0499	3.0796	3.1107	(40)
HLP (average)												3.0643	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3082 (42)
Hot water usage for mixer showers													
63.4610	62.5073	61.1176	58.4586	56.4963	54.3081	53.0642	54.4434	55.9553	58.3049	61.0210	63.2179	63.2179	(42a)
Hot water usage for baths													
21.0218	20.7096	20.2700	19.4593	18.8523	18.1793	17.8157	18.2523	18.7277	19.4479	20.2752	20.9508	20.9508	(42b)
Hot water usage for other uses													
29.5023	28.4295	27.3567	26.2839	25.2111	24.1383	24.1383	25.2111	26.2839	27.3567	28.4295	29.5023	29.5023	(42c)
Average daily hot water use (litres/day)												104.8198	(43)
Daily hot water use													
113.9851	111.6464	108.7443	104.2018	100.5598	96.6256	95.0182	97.9068	100.9668	105.1094	109.7256	113.6709	113.6709	(44)
Energy conte	180.5246	158.9830	167.1359	142.6471	135.3728	118.8124	114.9163	121.2291	124.5022	142.6325	156.3243	177.9812	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
27.0787	23.8475	25.0704	21.3971	20.3059	17.8219	17.2374	18.1844	18.6753	21.3949	23.4486	26.6972	26.6972	(46)
Water storage loss (or HIU loss):													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9390	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0471	(55)
Total storage loss													
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	(56)
If cylinder contains dedicated solar storage													
32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
236.2459	209.3119	221.4614	189.8173	178.2997	160.1295	157.6106	164.8539	173.0231	196.9580	210.2481	233.7025	233.7025	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												602.8205	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												602.8205	
Solar input	-0.0000	-16.2430	-57.3356	-77.9818	-100.6524	-92.6601	-91.9171	-80.9446	-56.5485	-28.5374	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
236.2459	193.0689	164.1258	111.8355	77.6473	67.4694	65.6935	83.9092	116.4746	168.4206	210.2481	233.7025	233.7025	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
104.6014	93.1250	99.0331	85.1663	79.3530	72.5588	72.3651	75.2085	80.2137	90.8857	95.1169	103.7558	103.7558	(65)

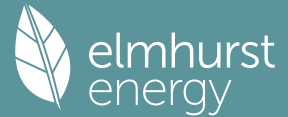
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
17.6333	15.6618	12.7370	9.6427	7.2081	6.0853	6.5754	8.5470	11.4717	14.5660	17.0007	18.1234	18.1234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)													
-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)													
140.5933	138.5788	133.1090	118.2866	106.6573	100.7761	97.2650	101.0867	111.4079	122.1582	132.1068	139.4567	139.4567	(72)
Total internal gains													
395.6923	393.4406	380.6753	353.4539	327.6443	309.6013	299.2053	303.2642	320.8809	344.0302	368.1590	387.6708	387.6708	(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
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North	2.1000	10.6334	0.8500	0.7000	0.7700	9.2075 (74)
East	1.0900	19.6403	0.8500	0.7000	0.7700	8.8272 (76)
West	1.9400	19.6403	0.8500	0.7000	0.7700	15.7108 (80)

Solar gains	33.7455	65.5976	108.9518	163.3193	205.9918	213.9004	202.3666	169.5873	127.8899	77.9037	41.9547	27.8547 (83)
Total gains	429.4378	459.0383	489.6271	516.7732	533.6361	523.5017	501.5720	472.8515	448.7709	421.9340	410.1137	415.5256 (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	7.3164	7.3536	7.3911	7.5796	7.6160	7.7906	7.7906	7.8238	7.7224	7.6160	7.5426	7.4673
alpha	1.4878	1.4902	1.4927	1.5053	1.5077	1.5194	1.5194	1.5216	1.5148	1.5077	1.5028	1.4978
util living area	0.9141	0.9020	0.8792	0.8389	0.7776	0.6835	0.5861	0.6164	0.7457	0.8476	0.8964	0.9174 (86)
Living	15.9255	16.2383	16.9156	17.8940	18.9017	19.8382	20.3691	20.2899	19.5555	18.2877	16.9753	15.8968
Non living	14.4576	14.7678	15.4354	16.4044	17.3612	18.2087	18.6003	18.5632	17.9848	16.8056	15.5200	14.4457
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	18.4584	16.2383	16.9156	17.8940	18.9017	19.8382	20.3691	20.2899	19.5555	18.2877	16.9753	16.6298 (87)
Th 2	18.6651	18.6727	18.6803	18.7180	18.7252	18.7592	18.7592	18.7656	18.7460	18.7252	18.7107	18.6957 (88)
util rest of house	0.8964	0.8815	0.8519	0.7974	0.7079	0.5558	0.3735	0.4150	0.6376	0.7997	0.8711	0.9005 (89)
MIT 2	16.5577	14.7678	15.4354	16.4044	17.3612	18.2087	18.6003	18.5632	17.9848	16.8056	15.5200	15.0561 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0688	15.1632	15.8334	16.8049	17.7754	18.6468	19.0759	19.0274	18.4071	17.2041	15.9113	15.4792 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0688	15.1632	15.8334	16.8049	17.7754	18.6468	19.0759	19.0274	18.4071	17.2041	15.9113	15.4792 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8805	0.8334	0.8012	0.7473	0.6678	0.5474	0.4122	0.4459	0.6152	0.7522	0.8231	0.8653 (94)
Useful gains	378.1291	382.5462	392.2890	386.1893	356.3794	286.5764	206.7232	210.8276	276.0673	317.3840	337.5825	359.5616 (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	1465.4966	1171.9673	1060.3756	875.7542	669.8477	436.1879	266.8680	281.9973	468.3393	728.1417	980.9552	1268.3689 (97)
Space heating kWh	809.0015	530.4910	497.0564	352.4867	233.2204	0.0000	0.0000	0.0000	0.0000	305.6037	463.2283	676.1526 (98a)
Space heating requirement - total per year (kWh/year)	3867.2406											
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	809.0015	530.4910	497.0564	352.4867	233.2204	0.0000	0.0000	0.0000	0.0000	305.6037	463.2283	676.1526 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3867.2406											
Space heating per m2	(98c) / (4) = 106.9776 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												214.1339 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	809.0015	530.4910	497.0564	352.4867	233.2204	0.0000	0.0000	0.0000	0.0000	305.6037	463.2283	676.1526 (98)
Space heating efficiency (main heating system 1)	214.1339	214.1339	214.1339	214.1339	214.1339	0.0000	0.0000	0.0000	0.0000	214.1339	214.1339	214.1339 (210)
Space heating fuel (main heating system)	377.8017	247.7380	232.1241	164.6104	108.9133	0.0000	0.0000	0.0000	0.0000	142.7162	216.3265	315.7616 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	236.2459	193.0689	164.1258	111.8355	77.6473	67.4694	65.6935	83.9092	116.4746	168.4206	210.2481	233.7025 (64)
Efficiency of water heater (217)m	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175	165.9175 (216)
Fuel for water heating, kWh/month	142.3876	116.3644	98.9201	67.4043	46.7987	40.6644	39.5941	50.5729	70.2003	101.5086	126.7185	140.8546 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	15.4343	12.3820	11.1486	8.1680	6.3092	5.1546	5.7554	7.4811	9.7172	12.7496	14.4006	15.8633 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.2134	-55.5878	-82.2641	-91.9950	-93.6168	-67.5269	-66.6506	-65.7881	-62.1496	-62.4669	-41.8182	-32.2922 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												

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Space heating fuel - main system 1	1805.9919 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	165.9175
Water heating fuel used	1041.9886 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:	
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	80.0000 (231)
Electricity for lighting (calculated in Appendix L)	124.5640 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-760.3696 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2292.1748 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1805.9919	16.4900	297.8081 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1041.9886	16.4900	171.8239 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	124.5640	16.4900	20.5406 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-760.3696	16.4900	-125.3850
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-125.3850 (252)
Total energy cost			377.9796 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.6768 (257)
SAP value		72.8190
SAP rating (Section 12)		73 (258)
SAP band		C

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	1805.9919	0.1540	278.1944 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1041.9886	0.1460	152.1807 (264)
Space and water heating			430.3752 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	124.5640	0.1443	17.9784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-760.3696	0.1364	-103.7476
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-103.7476 (269)
Total CO2, kg/year			355.7030 (272)
CO2 emissions per m2			9.8400 (273)
EI value			94.1264
EI rating			94 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Basement floor	12.3500 (1a)	x 2.0000 (2a)	= 24.7000 (1a) - (3a)
Ground floor	11.9000 (1b)	x 2.3600 (2b)	= 28.0840 (1b) - (3b)
First floor	11.9000 (1c)	x 2.6000 (2c)	= 30.9400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	83.7240 (5)

2. Ventilation rate

m3 per hour

Full SAP Calculation Printout



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

0 * 80 = 0.0000 (6a)
0 * 20 = 0.0000 (6b)
0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
2 * 10 = 20.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.2389 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
15.0000 (17)
0.9889 (18)
2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.8405 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate												
Effective ac	1.0087	0.9456	0.9246	0.8195	0.8195	0.7565	0.7775	0.7355	0.7775	0.8405	0.8616	0.9246 (22b)
	1.0087	0.9471	0.9274	0.8358	0.8358	0.7861	0.8023	0.7705	0.8023	0.8533	0.8711	0.9274 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Door			0.5100	3.0000	1.5300		(26)
Window			5.1300	4.0268	20.6577		(27)
Heatloss Floor 1			12.3500	0.2200	2.7170	110.0000	1358.5000 (28)
Basement wall	29.9700	1.9400	28.0300	0.3300	9.2499	9.0000	252.2700 (29a)
GF wall	32.5700	1.6000	30.9700	0.3900	12.0783	9.0000	278.7300 (29a)
FF Wall	33.8800	2.1000	31.7800	0.3600	11.4408	9.0000	286.0200 (29a)
joists	9.1700		9.1700	0.2100	1.9257	9.0000	82.5300 (30)
External Roof 2	3.5900		3.5900	0.3500	1.2565	9.0000	32.3100 (30)
Total net area of external elements Aum(A, m2)			121.5300				(31)
Fabric heat loss, W/K = Sum (A x U)					60.8559		(32)
Main dwelling							
Internal Wall 1			10.0000			9.0000	90.0000 (32c)
Internal Floor 1			11.9000			18.0000	214.2000 (32d)
Internal Floor 2			11.9000			18.0000	214.2000 (32d)
Internal Ceiling 1			11.9000			9.0000	107.1000 (32e)
Internal Ceiling 2			11.9000			9.0000	107.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3022.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							83.6227 (35)
Thermal bridges (Default value 0.200 * total exposed area)							24.3060 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 85.1619 (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	27.8681	26.1672	25.6243	23.0928	23.0928	21.7202	22.1655	21.2871	22.1655	23.5747	24.0688	25.6243 (38)
Heat transfer coeff	113.0300	111.3291	110.7862	108.2547	108.2547	106.8821	107.3275	106.4490	107.3275	108.7366	109.2307	110.7862 (39)
Average = Sum(39)m / 12 =												109.0329

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	3.1267	3.0796	3.0646	2.9946	2.9946	2.9566	2.9689	2.9446	2.9689	3.0079	3.0216	3.0646 (40)
HLP (average)												3.0161
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3082 (42)

Hot water usage for mixer showers
63.4610 62.5073 61.1176 58.4586 56.4963 54.3081 53.0642 54.4434 55.9553 58.3049 61.0210 63.2179 (42a)

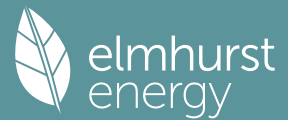
Hot water usage for baths
21.0218 20.7096 20.2700 19.4593 18.8523 18.1793 17.8157 18.2523 18.7277 19.4479 20.2752 20.9508 (42b)

Hot water usage for other uses
29.5023 28.4295 27.3567 26.2839 25.2111 24.1383 24.1383 25.2111 26.2839 27.3567 28.4295 29.5023 (42c)

Average daily hot water use (litres/day)
104.8198 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.9851	111.6464	108.7443	104.2018	100.5598	96.6256	95.0182	97.9068	100.9668	105.1094	109.7256	113.6709 (44)
Energy conte	180.5246	158.9830	167.1359	142.6471	135.3728	118.8124	114.9163	121.2291	124.5022	142.6325	156.3243	177.9812 (45)
Energy content (annual)												Total = Sum(45)m = 1741.0614
Distribution loss (46)m = 0.15 x (45)m	27.0787	23.8475	25.0704	21.3971	20.3059	17.8219	17.2374	18.1844	18.6753	21.3949	23.4486	26.6972 (46)
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9390 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0471 (55)
Total storage loss	32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589 (56)
If cylinder contains dedicated solar storage	32.4589	29.3177	32.4589	31.4118	32.4589	31.4118	32.4589	32.4589	31.4118	32.4589	31.4118	32.4589 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	236.2459	209.3119	221.4614	189.8173	178.2997	160.1295	157.6106	164.8539	173.0231	196.9580	210.2481	233.7025 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)

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Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												703.8394	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												703.8394	
Solar input	-0.8137	-19.8649	-62.9179	-89.6364	-108.9815	-107.0712	-105.0212	-95.2900	-68.4256	-38.9596	-6.8575	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	235.4322	189.4470	158.5435	100.1809	69.3182	53.0583	52.5894	69.5639	104.5975	157.9984	203.3906	233.7025	(64)
												1627.8225	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)
Heat gains from water heating, kWh/month	104.6014	93.1250	99.0331	85.1663	79.3530	72.5588	72.3651	75.2085	80.2137	90.8857	95.1169	103.7558	(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	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	78.4915	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6333	15.6618	12.7370	9.6427	7.2081	6.0853	6.5754	8.5470	11.4717	14.5660	17.0007	18.1234	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.1444	168.8789	164.5081	155.2034	143.4578	132.4186	125.0438	123.3093	127.6801	136.9848	148.7304	159.7696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	44.1573	(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)	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	-52.3277	(71)
Water heating gains (Table 5)	140.5933	138.5788	133.1090	118.2866	106.6573	100.7761	97.2650	101.0867	111.4079	122.1582	132.1068	139.4567	(72)
Total internal gains	395.6923	393.4406	380.6753	353.4539	327.6443	309.6013	299.2053	303.2642	320.8809	344.0302	368.1590	387.6708	(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					2.1000	12.7054	0.8500	0.7000	0.7700		11.0016 (74)	
East					1.0900	23.7288	0.8500	0.7000	0.7700		10.6648 (76)	
West					1.9400	23.7288	0.8500	0.7000	0.7700		18.9814 (80)	
Solar gains	40.6478	70.4418	116.7390	184.1348	222.7104	246.8191	230.9568	195.8743	146.6593	89.5387	51.0745	32.4178 (83)
Total gains	436.3401	463.8824	497.4143	537.5887	550.3547	556.4204	530.1621	499.1385	467.5402	433.5689	419.2335	420.0886 (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	7.4291	7.5426	7.5796	7.7568	7.7568	7.8564	7.8238	7.8884	7.8238	7.7224	7.6875	7.5796		
alpha	1.4953	1.5028	1.5053	1.5171	1.5171	1.5238	1.5216	1.5259	1.5216	1.5148	1.5125	1.5053		
util living area	0.9068	0.8954	0.8687	0.8192	0.7431	0.6256	0.5066	0.5145	0.6961	0.8203	0.8821	0.9088	(86)	
Living	16.2384	16.4925	17.2064	18.1943	19.2551	20.1179	20.5864	20.5909	19.8818	18.7216	17.4011	16.3131		
Non living	14.7780	15.0374	15.7385	16.7072	17.6947	18.4253	18.7108	18.7279	18.2643	17.2274	15.9515	14.8688		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10		
MIT	18.6144	16.4925	17.2064	18.1943	19.2551	20.1179	20.5864	20.5909	19.8818	18.7216	17.4011	16.9860	(87)	
Th 2	18.6880	18.7107	18.7180	18.7527	18.7527	18.7718	18.7656	18.7779	18.7656	18.7460	18.7392	18.7180	(88)	
util rest of house	0.8870	0.8731	0.8384	0.7722	0.6590	0.4709	0.2470	0.2442	0.5590	0.7592	0.8518	0.8892	(89)	
MIT 2	16.7291	15.0374	15.7385	16.7072	17.6947	18.4253	18.7108	18.7279	18.2643	17.2274	15.9515	15.4215	(90)	
Living area fraction									fLA = Living area / (4) =			0.2689	(91)	
MIT	17.2360	15.4287	16.1332	17.1071	18.1143	18.8804	19.2151	19.2289	18.6992	17.6292	16.3413	15.8421	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.2360	15.4287	16.1332	17.1071	18.1143	18.8804	19.2151	19.2289	18.6992	17.6292	16.3413	15.8421	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	379.9524	382.4026	391.7326	389.1046	345.0828	267.3624	165.6119	156.4704	258.8150	310.2541	336.6094	358.2283	(94)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000	(96)
Heat loss rate W	1383.0352	1116.4827	1000.7531	823.5022	596.9467	371.9935	194.8124	184.0350	397.0246	644.7169	900.2015	1179.0030	(97)
Space heating kWh	746.2936	493.3018	453.1113	312.7662	187.3867	0.0000	0.0000	0.0000	0.0000	248.8404	405.7864	610.6563	(98a)
Space heating requirement - total per year (kWh/year)												3458.1427	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													

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746.2936	493.3018	453.1113	312.7662	187.3867	0.0000	0.0000	0.0000	0.0000	248.8404	405.7864	610.6563 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											3458.1427
Space heating per m2											(98c) / (4) = 95.6609 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												213.5685 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	746.2936	493.3018	453.1113	312.7662	187.3867	0.0000	0.0000	0.0000	0.0000	248.8404	405.7864	610.6563 (98)
Space heating efficiency (main heating system 1)	213.5685	213.5685	213.5685	213.5685	213.5685	0.0000	0.0000	0.0000	0.0000	213.5685	213.5685	213.5685 (210)
Space heating fuel (main heating system)	349.4399	230.9806	212.1620	146.4477	87.7408	0.0000	0.0000	0.0000	0.0000	116.5155	190.0029	285.9300 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	235.4322	189.4470	158.5435	100.1809	69.3182	53.0583	52.5894	69.5639	104.5975	157.9984	203.3906	233.7025 (64)
Efficiency of water heater (217)m	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004	166.2004 (216)
Fuel for water heating, kWh/month	141.6556	113.9871	95.3930	60.2772	41.7076	31.9243	31.6422	41.8554	62.9346	95.0650	122.3767	140.6148 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	15.4343	12.3820	11.1486	8.1680	6.3092	5.1546	5.7554	7.4811	9.7172	12.7496	14.4006	15.8633 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.9483	-57.5677	-84.1704	-95.4199	-92.3789	-68.0765	-67.1586	-67.2253	-64.8404	-66.3931	-47.8224	-36.0880 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1619.2194 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												166.2004
Water heating fuel used												979.4334 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												124.5640 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-791.0895 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2012.1273 (238)

10a. Fuel costs - using BEDF prices (593)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1619.2194	27.6700	448.0380 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	979.4334	27.6700	271.0092 (247)
Energy for instantaneous electric shower(s)	0.0000	27.6700	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	27.6700	22.1360 (249)
Energy for lighting	124.5640	27.6700	34.4669 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-791.0895	27.6700	-218.8945
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-218.8945 (252)
Total energy cost			556.7556 (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	1619.2194	0.1544	250.0433 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	979.4334	0.1471	144.0849 (264)

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Space and water heating			394.1283 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	124.5640	0.1443	17.9784 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-791.0895	0.1369	-108.2881
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-108.2881 (269)
Total CO2, kg/year			314.9156 (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	1619.2194	1.5717	2544.8560 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	979.4334	1.5442	1512.4723 (278)
Space and water heating			4057.3283 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	124.5640	1.5338	191.0604 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-791.0895	1.5061	-1191.4322
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1191.4322 (283)
Total Primary energy kWh/year			3177.9804 (286)