



FALCON
ENERGY
LIMITED

Energy Conservation Specialists

**Slaugham Garden Nursery
Staplefield Road
Energy Statement**

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**Slaugham Garden Nursery, Staplefield Road, Slaugham
Energy Statement**

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0	27 th July 2026	Planning	NV-28072026	NV M057-001 Elmhurst

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1. Introduction

Falcon Energy has been instructed by DMA to undertake an energy/ sustainability report as part of a planning submission for the site known as Slaugham Garden Nursery.

The proposed works are for the conversion of a barn to a habitable dwelling.



Figure 1, Site Layout

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1.0 Energy Strategy.

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.
- networks where viable and feasible.
- Use renewable sources of energy.
- Explore opportunities for efficient energy supply through the use of communal heating
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.

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1.1 Energy efficient design, insulation, and ventilation.

The table below highlights the fabric first approach to the build.

Construction	Reduction Specification	Baseline Specification
External wall	0.26	0.30
Floor	0.15	0.25
Roof	0.14	0.16
Window	1.40 Double Glazed	1.40 Double Glazed
Door	1.40	1.40
Air Test	5	None
Boiler	ASHP	ASHP
Lighting	100% low energy	100% low energy
Solar	Yes 3.00 kWp	No

1.2 Energy Efficient fixtures and fittings.

All internal lights will be 100% low energy.

All external space lighting will be dedicated energy efficient, having a luminous efficacy greater than 40 lumens per circuit watt. Lighting will be controlled either through a time witch and/or PIR.

White goods will be provided. The fridges and freezers will be A+ rated and washing machines and dishwashers will be A rated under the EU Energy Efficiency Labelling Scheme.

1.3 Renewable Energies.

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

Providing the space heating requirement only using ground source heat pumps would provide a 31.7% CO2 reduction. This would require approximately 42 boreholes across the site, spaced between 25m to 50m centres, or horizontal coils would require an area of approximately 14,400m².

Using GSHP for 100% of the space heating will only provide a 21.8% reduction in predicted CO2 emissions, due to the high CO2 emissions associated with grid supplied electricity. This is an expensive technology. **Therefore, this is not considered to be viable for this project.**

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Air Source Heat Pumps

Air Source Heat Pumps extracts heat from the outside air using an external condenser unit and transfers it, through refrigeration pipework to the indoor unit which then conveys that heat to the heating emitters and hot water cylinder. This system is capable of providing 100% of heating within a building. Providing air source heat pumps to the building for the space heating would reduce the carbon dioxide emissions from the Lean building. This system would require 1 condenser unit to be located external to each plot, the units proposed are the following. The Ultra Quiet Eco-dan air source heat pump 8.5kW with sound levels that are three times quieter than previous models, virtually eliminating planning restrictions. They have been designed specifically for residential applications, these models offer superb, market-leading energy efficiency and sound levels and enable almost any home to benefit from high performance, renewable heating. The New Ultra Quiet Eco-dan takes this to the next level with low sound and high performance which mean homeowners can now choose the most convenient location for their heat pump, giving complete flexibility on placement and still meeting Permitted Development requirements.

The 8.5 kW Ultra Quiet Eco-dan has a sound power level of only 58 dB(A) which is an 8 dB(A) drop over the model it replaces. It also has a sound pressure level of just 45 dB(A) at one metre. Sound power can be thought of as the cause of a noise or the total sound energy emitted by a source in all directions, whereas sound pressure is the effect or the sound we hear and this is determined by the environment and by the distance from the source of sound. We think of this as the intensity or loudness of a sound. An ambulance registers 120 dB(A) whereas a vacuum-cleaner registers around 73 dB(A) and typical room conversation comes in at around 60 dB(A).

“With a sound pressure level of just 45 dB(A), the new Eco-dan is whisper-quiet, with levels just above that of a library, meaning it will pass the Permitted Development requirements easily and can be installed almost anywhere to suit the homeowner.

The ASHP's will be installed by an MCS accredited installer and designed to be the main heating source. Once full heat loss calculations have been carried out the final design will ensure the system is running to its optimum efficiency.

The ASHP will be offset with Solar P.V panels. As ASHP's are run by electricity this is the most efficient way to offset the carbon used to power the system.



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8.5 Kw Ecodan ASHP

OUTDOOR UNIT		PUZ-WM50VHA(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++
	η_s	129%
	SCOP (MCS)	3.22
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+++
	η_s	183%
	SCOP (MCS)	4.57
HEAT PUMP COMBINATION HEATER - Large Profile ¹	ErP Rating	A+
	η_{wh}	135%
HEATING ² (A-7/W35)	Capacity (kW)	5.0
	Power Input (kW)	1.67
	COP	3.00
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA ³	Pressure Level at 1m (dBA)	52
	Power Level (dBA) ⁴	61
WATER DATA	Pipework Size (mm)	22
	Flow Rate (l/min)	14
	Water Pressure Drop (kPa)	12.0
DIMENSIONS (mm)	Width	950
	Depth	330+30 ⁷
	Height	943
WEIGHT (kg)		71
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz
	Phase	Single
	Nominal Running Current [MAX] (A) ⁵	4.64 [13]
	Fuse Rating - MCB Sizes (A) ⁶	16
REFRIGERANT CHARGE (kg) / CO ₂ EQUIVALENT (t)	R32 (GWP 675)	2.0 / 1.35

CYLINDER			EHPT15X-UKHLDW
NOMINAL HOT WATER VOLUME (LITRES)			150
ErP RATING			C
HEAT LOSS (kWh/24hrs)			1.40
HEAT LOSS (W)			58
WATER		Flow Rate (l/min) - WM 50 / 60 / 85	14 / 17 / 24
		Primary Circuit Pump	Grundfos UPM
		Heating Circuit Pump	Grundfos UPI
		Sanitary Hot Water Pump	Grundfos UPSO
		Connection Size (mm) Heating / DHW	22 / 22
		Charge Pressure (MPa (Bar))	0.35 (3.5)
WATER SAFETY	Water Circuit	Control Thermistor (°C)	80
	DHW Cylinder	DHW Expansion Vessel (Litres)	12
		Control Thermistor (°C)	75
		Over Temperature Cut-Out (°C)	80 ± 5
		Temp and Pressure Relief Valve (°C) / (MPa (Bar))	90 / 1.0 (10)
		Expansion Relief Valve (Cold) (MPa (Bar))	0.8 (8)
DIMENSIONS (mm)		Width	649
		Depth	646
		Height	1515
WEIGHT EMPTY / FULL (kg)			54 / 204
CYLINDER MATERIAL	Cylinder	Cylinder Material	Stainless Steel
	Insulation	Insulation Type	CFC / HCFC-free flame-retardant
		Insulation Thickness (mm)	50
		GWP of Insulation	3.1
		ODP of Insulation	0
ELECTRICAL DATA	Control Board - optionally powered by outdoor unit	Electrical Supply	220-240v, 50Hz
		Phase	Single
		Fuse Rating - MCB Sizes (A)**	16
	Immersion Heater	Electrical Supply	220-240v, 50Hz
		Phase	Single
		Capacity (kW)	3
		Max Running Current (A)	13
		Fuse Rating - MCB Sizes (A)**	16
MECHANICAL ZONES			DHW and 1 Heating Zone
OPTIONAL SIMPLIFIED WIRELESS ROOM THERMOSTAT AND WIRELESS RECEIVER			PAR-WT50-E Controller and PAR-WT50-R Receiver

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Biomass

Waste timber, in the form of wood chips and pellets, is used as fuel in boilers providing heating to buildings. Biomass generates about the same amount of carbon dioxide as fossil fuels, however, with new plant/tree growth this carbon dioxide is actually removed from the atmosphere making the Biomass system carbon neutral. Wood chips and pellets present no risk if accidentally released into the environment and there are no harmful by-products. The flue gas is smoke-free and the ash content of between 0.5% and 3% by volume (depending on material), is minimal.

When sizing biomass is standard practice the biomass boilers would meet a significant proportion of the heating load and gas condensing boilers would assist with providing load trimming to reduce the amount of on/off cycling of the biomass boilers. The provision of biomass boilers to meet all the domestic hot water demand and 30% of the annual energy demand for space heating only would reduce the carbon emissions of the building by 40%.

The provision of biomass boilers for this site would require a central energy centre to be provided sized to allow for at least one biomass boiler and gas backup boiler(s). The number of boilers would be dependent upon detailed analysis of the demand load profiles during detail design stage. Storage of the biomass fuel is required on site, sized to accommodate at least one peak month of heating. Based on the predicted domestic hot water and 30% heating requirements, this would require 30m³ storage for wood pellets or 135m³ of woodchip, depending upon the boiler selection. The store would need to be easily accessed by a large delivery vehicle, similarly, sized to a petrol tanker and therefore there may be issues surrounding vehicular access to the site.

The space and access requirements for the energy centre and biomass store **are unlikely to be viable on this site**. Furthermore, the biomass boiler(s) would require a large flue and careful consideration of its sizing, location and the potential impact of local air quality.

Solar thermal

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

Photovoltaics

Solar photovoltaic (PV) technology is a semi-conductor-based technology that converts the energy in sunlight into electricity. The term describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a

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flow of current when the solar cell is connected to an electrical load. The PV systems should be unshaded. Shading even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid; and feed-in tariffs are available. **This was felt most viable** as approximately 8 panels would be required totalling 13.68 sqm and providing 3.00 kWp output.



1.4 Innovative waste facilities.

Recycling storage will comply with the local authority requirements for recycling externally and internally. External storage areas will be in compliance with disabled access and volumes will be in line with BS5906.

The separation for recyclables will be provided in a fixed position in the kitchen with 30 litres to be provided for waste and minimum 30 litres for recyclables. A recycling bin with a 44-litre capacity will be provided.



1.5 Electric Vehicle Provision

The site will have 1 dedicated electric vehicle charging.

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1.6 Water Saving devices

Mains water usage shall be significantly reduced through water efficient products in line with the mandatory requirements. An indicative specification for the development is:

Shower of 6 litres/minute

Bath sizes to be 140 litres to overflow

Washbasin taps to be flow limited to 6 litres/minute

Dual Flush WCs at 6/4 litre

Low water use white goods

The above specifications will give a usage of 110 litres/person/day

1.7 Sustainable materials and construction

The design team are committed to ensuring that at least 5 elements build are A rated under the BRE Green Guide.

All concrete used within the development will have BES:6001 certification under an environmental management system (EMS) such as ISO14001. All timber used within the development will be wither PEFC or FSC certified.

Building Elements all skirting, stairs, doors and other timber finishing elements will be sourced from FSC or PEFC certified timber.

1.8 Summary of carbon reduction

Plot Number	DER KgCO ₂ /yr/m ²	Baseline TER KgCO ₂ /yr/m ²	% Improvement in CO ₂
Unit 1	3.52	7.14	50.70

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1.9 **Baseline/Reduction** SAP Calculations

Full SAP Calculation Printout



Plot Reference	Slaugham baseline			Issued on Date	29/07/2026	
Assessment Reference	00001		Plot Type Ref			
Plot Address				SAP Version	10.2	
SAP Rating	69 C		DER	7.14	TER	
Environmental	94 A		% DER < TER			N/A
CO ₂ Emissions (t/year)	0.61		DFEE	97.51	TFEE	
Compliance Check	N/A		% DFEE < TFEE			
% DPER < TPER			DPER	74.33	TPER	
Assessor Details	Mr. Neil Vanson				Assessor ID	M057-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	244.0944 (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	3 * 10 = 30.0000 (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)	30.0000 / (5) = 0.1229 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8729 (21)

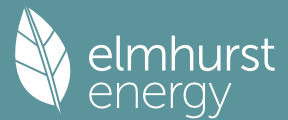
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	1.1130	1.0911	1.0693	0.9602	0.9384	0.8293	0.8293	0.8074	0.8729	0.9384	0.9820	1.0257 (22b)
Effective ac	1.1130	1.0911	1.0693	0.9610	0.9403	0.8438	0.8438	0.8260	0.8810	0.9403	0.9822	1.0257 (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							
Opening Type 1			22.8600	1.3258	30.3068		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			92.4600	0.2500	23.1150	110.0000	10170.6000 (28a)
External Wall 1	111.4800	24.7500	86.7300	0.3000	26.0190	9.0000	780.5700 (29a)
External Roof 1	92.4600		92.4600	0.1600	14.7936	9.0000	832.1400 (30)
Total net area of external elements Aum(A, m ²)			296.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.8804		(33)
Main dwelling							
Internal Wall 1			85.0000			9.0000	765.0000 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	12548.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.7161 (35)
Thermal bridges (Default value 0.200 * total exposed area)							59.2800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	156.1604 (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	89.6495	87.8917	86.1339	77.4085	75.7398	67.9718	67.9718	66.5333	70.9640	75.7398	79.1156	82.6182 (38)
Heat transfer coeff												

Full SAP Calculation Printout



Average = Sum(39)m / 12 =	245.8100	244.0521	242.2943	233.5689	231.9003	224.1323	224.1323	222.6937	227.1244	231.9003	235.2760	238.7786 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.6586	2.6395	2.6205	2.5262	2.5081	2.4241	2.4241	2.4085	2.4565	2.5081	2.5446	2.5825 (40)
HLP (average)												2.5251
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6579 (42)
Hot water usage for mixer showers												
68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207 (42a)	
Hot water usage for baths												
31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603 (42b)	
Hot water usage for other uses												
44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523 (42c)	
Average daily hot water use (litres/day)												132.4529 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334 (44)
Energy content	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)
Energy content (annual)										Total = Sum(45)m =		2200.0088
Distribution loss (46)m = 0.15 x (45)m												
34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578 (46)	
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5900 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.2402 (55)
Total storage loss												
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (56)	
If cylinder contains dedicated solar storage												
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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												
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (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												
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)	
Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			3174.2434 (64)
Electric shower(s)												3174 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158 (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	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.8336	135.9944	122.8336	126.9281	122.8336	126.9281	122.8336	122.8336	126.9281	122.8336	126.9281	122.8336 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.5314	246.0585	239.6903	226.1332	209.0197	192.9355	182.1902	179.6631	186.0313	199.5885	216.7019	232.7861 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896 (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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
Total internal gains	590.2154	603.2555	578.6474	558.0817	530.0667	476.9912	457.7958	458.8866	473.5887	524.9168	556.7698	578.0527 (73)

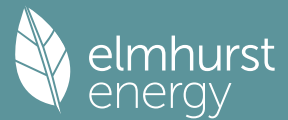
6. Solar gains

[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
Northeast	2.0000	11.2829	0.7600	0.7000	0.7700	8.3195 (75)
Southeast	11.3400	36.7938	0.7600	0.7000	0.7700	153.8271 (77)
Southwest	6.1600	36.7938	0.7600	0.7000	0.7700	83.5604 (79)
Northwest	3.3600	11.2829	0.7600	0.7000	0.7700	13.9768 (81)
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262 (83)
Total gains	849.8992	1052.9990	1213.6775	1377.8872	1478.4127	1431.7173 (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	14.1802	14.2824	14.3860	14.9234	15.0308	15.5517	15.5517	15.6522	15.3468	15.0308	14.8151	14.5978
alpha	1.9453	1.9522	1.9591	1.9949	2.0021	2.0368	2.0368	2.0435	2.0231	2.0021	1.9877	1.9732
util living area												
	0.9626	0.9428	0.9147	0.8617	0.7822	0.6713	0.5556	0.5955	0.7603	0.8873	0.9463	0.9665 (86)
Living	17.7209	18.0432	18.5434	19.2463	19.8672	20.3782	20.6277	20.5862	20.1795	19.3767	18.4646	17.7189

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Non living	15.3844	15.7878	16.4102	17.2905	18.0208	18.5973	18.8056	18.7909	18.4070	17.4760	16.3443	15.3990
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	19.3249	18.0432	18.5434	19.2463	19.8672	20.3782	20.6277	20.5862	20.1795	19.3767	18.4646	18.1783 (87)
Th 2	18.9304	18.9411	18.9517	19.0056	19.0161	19.0656	19.0656	19.0749	19.0464	19.0161	18.9950	18.9733 (88)
util rest of house												
	0.9532	0.9286	0.8923	0.8223	0.7116	0.5460	0.3623	0.4086	0.6549	0.8466	0.9304	0.9582 (89)
MIT 2	17.4984	15.7878	16.4102	17.2905	18.0208	18.5973	18.8056	18.7909	18.4070	17.4760	16.3443	16.0372 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	18.3170	16.7986	17.3663	18.1671	18.8483	19.3955	19.6222	19.5955	19.2014	18.3279	17.2946	16.9968 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3170	16.7986	17.3663	18.1671	18.8483	19.3955	19.6222	19.5955	19.2014	18.3279	17.2946	16.9968 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9497	0.9074	0.8685	0.8009	0.7043	0.5712	0.4263	0.4677	0.6653	0.8275	0.9109	0.9466 (94)
Useful gains	807.1533	955.4773	1054.0421	1103.5669	1041.1743	817.8036	585.1805	596.7450	779.9188	850.0415	791.7398	756.7423 (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	3445.5196	2903.8906	2632.8446	2164.5002	1657.7014	1074.8239	677.3809	711.6239	1158.6591	1792.1004	2398.5413	3055.6044 (97)
Space heating kWh	1962.9446	1309.3337	1174.6290	763.8720	458.6962	0.0000	0.0000	0.0000	0.0000	700.8918	1156.8970	1710.3534 (98a)
Space heating requirement - total per year (kWh/year)												9237.6177
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	1962.9446	1309.3337	1174.6290	763.8720	458.6962	0.0000	0.0000	0.0000	0.0000	700.8918	1156.8970	1710.3534 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9237.6177
Space heating per m2										(98c) / (4) =		99.9093 (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 %)												373.0357 (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	1962.9446	1309.3337	1174.6290	763.8720	458.6962	0.0000	0.0000	0.0000	0.0000	700.8918	1156.8970	1710.3534 (98)
Space heating efficiency (main heating system 1)	373.0357	373.0357	373.0357	373.0357	373.0357	0.0000	0.0000	0.0000	0.0000	373.0357	373.0357	373.0357 (210)
Space heating fuel (main heating system)	526.2083	350.9942	314.8838	204.7718	122.9631	0.0000	0.0000	0.0000	0.0000	187.8887	310.1304	458.4959 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
Efficiency of water heater (217)m	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873 (216)
Fuel for water heating, kWh/month	175.7101	155.7815	166.2615	147.7593	144.3607	114.5780	113.0710	117.4951	118.7218	149.5960	157.3674	173.9768 (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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (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												2476.3363 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.9873
Water heating fuel used												1734.6792 (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)												219.4653 (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												4430.4808 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2476.3363	0.1546	382.7391 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1734.6792	0.1416	245.5985 (264)
Space and water heating			628.3376 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Total CO2, kg/year			660.0133 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.1400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2476.3363	1.5722	3893.1996 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1734.6792	1.5236	2642.8966 (278)
Space and water heating			6536.0962 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Total Primary energy kWh/year			6872.7195 (286)
Dwelling Primary energy Rate (DPER)			74.3300 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 244.0944 (5)

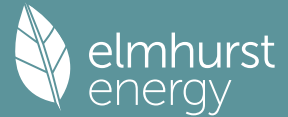
2. Ventilation rate

	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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1229 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8729 (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	1.1130 1.0911 1.0693 0.9602 0.9384 0.8293 0.8293 0.8074 0.8729 0.9384 0.9820 1.0257 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000 (23b)
Effective ac	1.1130 1.0911 1.0693 0.9610 0.9403 0.8438 0.8438 0.8260 0.8810 0.9403 0.9822 1.0257 (23c)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			22.8600	1.3258	30.3068		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			92.4600	0.2500	23.1150	110.0000	10170.6000 (28a)
External Wall 1	111.4800	24.7500	86.7300	0.3000	26.0190	9.0000	780.5700 (29a)
External Roof 1	92.4600		92.4600	0.1600	14.7936	9.0000	832.1400 (30)
Total net area of external elements Aum(A, m2)			296.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		96.8804		(33)
Main dwelling							
Internal Wall 1			85.0000			9.0000	765.0000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12548.3100 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 135.7161 (35)
 Thermal bridges (Default value 0.200 * total exposed area) 59.2800 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 156.1604 (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	89.6495	87.8917	86.1339	77.4085	75.7398	67.9718	67.9718	66.5333	70.9640	75.7398	79.1156	82.6182 (38)
Heat transfer coeff	245.8100	244.0521	242.2943	233.5689	231.9003	224.1323	224.1323	222.6937	227.1244	231.9003	235.2760	238.7786 (39)
Average = Sum(39)m / 12 =												233.4719
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.6586	2.6395	2.6205	2.5262	2.5081	2.4241	2.4241	2.4085	2.4565	2.5081	2.5446	2.5825 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579 (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													
29.7027	29.2616	28.6404	27.4950	26.6374	25.6864	25.1727	25.7895	26.4612	27.4788	28.6477	29.6023		(42b)
Hot water usage for other uses													
41.8497	40.3279	38.8061	37.2843	35.7625	34.2407	34.2407	35.7625	37.2843	38.8061	40.3279	41.8497		(42c)
Average daily hot water use (litres/day)													65.5843 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
71.5524	69.5895	67.4465	64.7793	62.3999	59.9271	59.4134	61.5520	63.7455	66.2849	68.9757	71.4520		(44)
Energy conte	113.3216	99.0945	103.6628	88.6796	84.0022	73.6873	71.8553	76.2143	78.6046	89.9480	98.2685	111.8766	(45)
Energy content (annual)										Total = Sum(45)m =		1089.2153	
Distribution loss (46)m = 0.15 x (45)m													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
96.3233	84.2304	88.1133	75.3777	71.4019	62.6342	61.0770	64.7821	66.8139	76.4558	83.5282	95.0951		(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	96.3233	84.2304	88.1133	75.3777	71.4019	62.6342	61.0770	64.7821	66.8139	76.4558	83.5282	95.0951	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 925.8330 (64)
Electric shower(s)													926 (64)
55.0848	49.0810	53.5945	51.1446	52.1043	49.7025	51.3592	52.1043	51.1446	53.5945	52.5868	55.0848		(64a)
Heat gains from water heating, kWh/month													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 626.5858 (64a)
37.8520	33.3278	35.4270	31.6306	30.8765	28.0842	28.1091	29.2216	29.4896	32.5126	34.0287	37.5450		(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	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.8336	135.9944	122.8336	126.9281	122.8336	126.9281	122.8336	122.8336	126.9281	122.8336	126.9281	122.8336 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.5314	246.0585	239.6903	226.1332	209.0197	192.9355	182.1902	179.6631	186.0313	199.5885	216.7019	232.7861 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896 (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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Water heating gains (Table 5)	50.8764	49.5950	47.6169	43.9314	41.5007	39.0058	37.7810	39.2764	40.9578	43.6997	47.2621	50.4637 (72)
Total internal gains	480.1101	494.5166	473.0095	459.8613	436.2228	421.7381	405.6736	404.6419	416.7860	428.9905	453.7609	468.9522 (73)

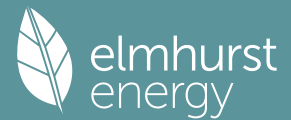
6. Solar gains

[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		
-----				-----								
Northeast				2.0000	11.2829		0.7600	0.7000		0.7700		8.3195 (75)
Southeast				11.3400	36.7938		0.7600	0.7000		0.7700		153.8271 (77)
Southwest				6.1600	36.7938		0.7600	0.7000		0.7700		83.5604 (79)
Northwest				3.3600	11.2829		0.7600	0.7000		0.7700		13.9768 (81)
-----				-----								
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625 (83)
Total gains	739.7939	944.2601	1108.0397	1279.6668	1384.5689	1376.4643	1320.6224	1221.6698	1115.4875	931.3569	766.1509	690.3147 (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	14.1802	14.2824	14.3860	14.9234	15.0308	15.5517	15.5517	15.6522	15.3468	15.0308	14.8151	14.5978

Full SAP Calculation Printout



alpha	1.9453	1.9522	1.9591	1.9949	2.0021	2.0368	2.0368	2.0435	2.0231	2.0021	1.9877	1.9732
util living area	0.9706	0.9523	0.9262	0.8758	0.7996	0.6844	0.5693	0.6108	0.7744	0.9031	0.9566	0.9742 (86)
MIT	16.7086	17.1456	17.8236	18.7779	19.6273	20.3445	20.6880	20.6284	20.0700	18.9457	17.7069	16.7011 (87)
Th 2	18.9304	18.9411	18.9517	19.0056	19.0161	19.0656	19.0656	19.0749	19.0464	19.0161	18.9950	18.9733 (88)
util rest of house	0.9630	0.9402	0.9062	0.8393	0.7319	0.5599	0.3740	0.4227	0.6716	0.8667	0.9435	0.9676 (89)
MIT 2	15.2765	15.7112	16.3810	17.3297	18.1225	18.7591	18.9875	18.9690	18.5515	17.5192	16.3010	15.2916 (90)
Living area fraction	15.9184	16.3541	17.0276	17.9788	18.7969	19.4697	19.7497	19.7127	19.2321	18.1585	16.9311	15.9233 (92)
MIT	15.9184	16.3541	17.0276	17.9788	18.7969	19.4697	19.7497	19.7127	19.2321	18.1585	16.9311	15.9233 (93)
Temperature adjustment												0.0000
adjusted MIT												0.0000

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9455	0.9170	0.8793	0.8143	0.7226	0.5905	0.4529	0.4951	0.6838	0.8446	0.9228	0.9517 (94)
Useful gains	699.4386	865.9294	974.3332	1042.0392	1000.4714	812.8352	598.0900	604.8470	762.7808	786.5966	706.9849	656.9575 (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	2855.9181	2795.3996	2550.7657	2120.5166	1645.7830	1091.4494	705.9399	737.7284	1165.6137	1752.8238	2313.0273	2799.2800 (97)
Space heating kWh	1604.4208	1296.6040	1172.8658	776.5038	480.1118	0.0000	0.0000	0.0000	0.0000	718.8730	1156.3505	1593.8879 (98a)
Space heating requirement - total per year (kWh/year)												8799.6176
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	1604.4208	1296.6040	1172.8658	776.5038	480.1118	0.0000	0.0000	0.0000	0.0000	718.8730	1156.3505	1593.8879 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8799.6176
Space heating per m2										(98c) / (4) =		95.1722 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2106.8432	1658.5787	1692.4724	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5664	0.6359	0.6021	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1193.3541	1054.6925	1018.9801	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1560.3941	1497.5042	1384.2568	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	264.2688	329.4519	271.7658	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	66.0672	82.3630	67.9415	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												216.3716 (107)
Energy for space heating												95.1722 (99)
Energy for space cooling												2.3402 (108)
Total												97.5123 (109)
Fabric Energy Efficiency (DFEE)												97.5 (109)

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

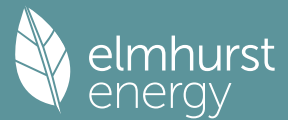
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	244.0944 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	30.0000 / (5) = 0.1229 (8)
Infiltration due to chimneys, flues and fans	No
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8729 (18)
Number of sides sheltered	0 (19)

Full SAP Calculation Printout



Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 1.0000 \quad (20)$$
$$(21) = (18) \times (20) = 0.8729 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	1.1130	1.0911	1.0693	0.9602	0.9384	0.8293	0.8293	0.8074	0.8729	0.9384	0.9820	1.0257	(22b)
	1.1130	1.0911	1.0693	0.9610	0.9403	0.8438	0.8438	0.8260	0.8810	0.9403	0.9822	1.0257	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			22.8600	1.3258	30.3068			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Heatloss Floor 1			92.4600	0.2500	23.1150	110.0000	10170.6000	(28a)
External Wall 1	111.4800	24.7500	86.7300	0.3000	26.0190	9.0000	780.5700	(29a)
External Roof 1	92.4600		92.4600	0.1600	14.7936	9.0000	832.1400	(30)
Total net area of external elements Aum(A, m2)			296.4000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	96.8804		(33)
Main dwelling								
Internal Wall 1			85.0000			9.0000	765.0000	(32c)

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

$$(28)...(30) + (32) + (32a)...(32e) = 12548.3100 \quad (34)$$
$$135.7161 \quad (35)$$
$$59.2800 \quad (36)$$
$$(36a) = 0.0000$$
$$(33) + (36) + (36a) = 156.1604 \quad (37)$$

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	89.6495	87.8917	86.1339	77.4085	75.7398	67.9718	67.9718	66.5333	70.9640	75.7398	79.1156	82.6182	(38)
Heat transfer coeff	245.8100	244.0521	242.2943	233.5689	231.9003	224.1323	224.1323	222.6937	227.1244	231.9003	235.2760	238.7786	(39)
Average = Sum(39)m / 12 =												233.4719	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.6586	2.6395	2.6205	2.5262	2.5081	2.4241	2.4241	2.4085	2.4565	2.5081	2.5446	2.5825	(40)
HLP (average)												2.5251	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

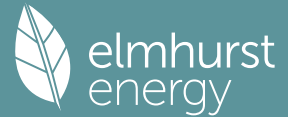
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579	(42)
Hot water usage for mixer showers														
68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207	68.5207	(42a)	
Hot water usage for baths														
31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603	31.1603	(42b)	
Hot water usage for other uses														
44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523	44.0523	(42c)	
Average daily hot water use (litres/day)													132.4529	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334	143.7334	(44)	
Energy conte	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518	(45)	
Energy content (annual)										Total =	Sum(45)m =	2200.0088		
Distribution loss (46)m = 0.15 x (45)m														
34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578	33.7578	(46)	
Water storage loss (or HIU loss):														
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5900	(48)
Temperature factor from Table 2b													0.7800	(49)
Enter (49) or (54) in (55)													1.2402	(55)
Total storage loss														
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	(56)	
If cylinder contains dedicated solar storage														
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	(57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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														
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	318.3556	(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														
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	318.3556	(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														
119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158	118.7158	(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	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	(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)													
	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)

Full SAP Calculation Printout



Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
Total internal gains	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010 (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
Northeast					2.0000	11.2829		0.7600		0.7000	0.7700	8.3195 (75)
Southeast					11.3400	36.7938		0.7600		0.7000	0.7700	153.8271 (77)
Southwest					6.1600	36.7938		0.7600		0.7000	0.7700	83.5604 (79)
Northwest					3.3600	11.2829		0.7600		0.7000	0.7700	13.9768 (81)
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625 (83)
Total gains	921.9765	1109.6866	1275.2363	1423.2223	1515.1237	1454.4338	1395.1265	1300.5254	1201.0963	1072.3126	922.8135	867.0636 (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, n _{l,m} (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.1802	14.2824	14.3860	14.9234	15.0308	15.5517	15.5517	15.6522	15.3468	15.0308	14.8151	14.5978
alpha	1.9453	1.9522	1.9591	1.9949	2.0021	2.0368	2.0368	2.0435	2.0231	2.0021	1.9877	1.9732
util living area	0.9570	0.9377	0.9079	0.8551	0.7755	0.6661	0.5499	0.5888	0.7532	0.8798	0.9406	0.9614 (86)
Living	17.7819	18.0888	18.5890	19.2754	19.8854	20.3857	20.6321	20.5921	20.1928	19.4081	18.5089	17.7777
Non living	15.4595	15.8430	16.4641	17.3229	18.0386	18.6028	18.8073	18.7935	18.4183	17.5109	16.3978	15.4717
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	19.3561	18.0888	18.5890	19.2754	19.8854	20.3857	20.6321	20.5921	20.1928	19.4081	18.5089	18.2290 (87)
Th 2	18.9304	18.9411	18.9517	19.0056	19.0161	19.0656	19.0656	19.0749	19.0464	19.0161	18.9950	18.9733 (88)
util rest of house	0.9464	0.9224	0.8841	0.8145	0.7038	0.5404	0.3575	0.4025	0.6466	0.8372	0.9233	0.9519 (89)
MIT 2	17.5287	15.8430	16.4641	17.3229	18.0386	18.6028	18.8073	18.7935	18.4183	17.5109	16.3978	16.0969 (90)
Living area fraction	18.3477	16.8495	17.4165	18.1980	18.8663	19.4019	19.6252	19.5997	19.2136	18.3612	17.3440	17.0525 (92)
MIT	18.3477	16.8495	17.4165	18.1980	18.8663	19.4019	19.6252	19.5997	19.2136	18.3612	17.3440	17.0525 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3477	16.8495	17.4165	18.1980	18.8663	19.4019	19.6252	19.5997	19.2136	18.3612	17.3440	17.0525 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9427	0.9003	0.8598	0.7934	0.6972	0.5661	0.4213	0.4616	0.6579	0.8183	0.9029	0.9393 (94)
Ext temp.	869.1111	999.0613	1096.4244	1129.1553	1056.3488	823.3689	587.7923	600.3631	790.2200	877.4544	833.2464	814.4664 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	3453.0665	2916.3112	2645.0023	2171.7238	1661.8766	1076.2602	678.0458	712.5425	1161.4254	1799.8194	2410.1692	3068.8947 (97)
Space heating requirement - total per year (kWh/year)	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98c)
Space heating per m2										(98c) / (4) =		98.0216 (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 %)	373.0357 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98)
Space heating efficiency (main heating system 1)	373.0357	373.0357	373.0357	373.0357	373.0357	0.0000	0.0000	0.0000	0.0000	373.0357	373.0357	373.0357 (210)
Space heating fuel (main heating system)	515.3563	345.3804	308.8557	201.2272	120.7693	0.0000	0.0000	0.0000	0.0000	183.9608	304.3635	449.6338 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
Water heating requirement	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873 (216)
Efficiency of water heater (217)m	175.7101	155.7815	166.2615	147.7593	144.3607	114.5780	113.0710	117.4951	118.7218	149.5960	157.3674	173.9768 (219)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Space cooling fuel requirement (221)m	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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)												

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(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												2429.5471	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												182.9873	
Water heating fuel used												1734.6792	(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)												219.4653	(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												4383.6916	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2429.5471	16.4900	400.6323 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1734.6792	16.4900	286.0486 (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	219.4653	16.4900	36.1898 (250)
Additional standing charges			0.0000 (251)
Total energy cost			722.8708 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)			[(255) x (256)] / [(4) + 45.0] = 1.8932 (257)
SAP value			69.3119
SAP rating (Section 12)			69 (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	2429.5471	0.1546	375.5038 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1734.6792	0.1416	245.5985 (264)
Space and water heating			621.1023 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Total CO2, kg/year			652.7779 (272)
CO2 emissions per m2			7.0600 (273)
EI value			93.6365
EI rating			94 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	244.0944 (5)

2. Ventilation rate

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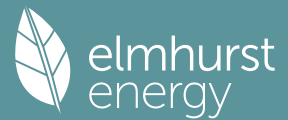


												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												3 * 10 =	30.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											30.0000 / (5) =	0.1229 (8)
Pressure test												No	
Pressure Test Method												Blower Door	
Measured/design AP50												15.0000 (17)	
Infiltration rate												0.8729 (18)	
Number of sides sheltered												0 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.8729 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
	1.0475	0.9820	0.9602	0.8511	0.8511	0.7856	0.8074	0.7638	0.8074	0.8729	0.8947	0.9602	(22b)
Effective ac	1.0475	0.9822	0.9610	0.8622	0.8622	0.8086	0.8260	0.7917	0.8260	0.8810	0.9003	0.9610	(22c)

3. Heat losses and heat loss parameter													
Element	Gross		Openings	NetArea	U-value	A x U	K-value	A x K					
Main dwelling	m2		m2	m2	W/m2K	W/K	kJ/m2K	kJ/K					
Opening Type 1				22.8600	1.3258	30.3068		(27)					
Opening Type 2				1.8900	1.4000	2.6460		(26)					
Heatloss Floor 1				92.4600	0.2500	23.1150	110.0000	10170.6000	(28a)				
External Wall 1	111.4800		24.7500	86.7300	0.3000	26.0190	9.0000	780.5700	(29a)				
External Roof 1	92.4600			92.4600	0.1600	14.7936	9.0000	832.1400	(30)				
Total net area of external elements Aum(A, m2)				296.4000					(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		96.8804	(33)					
Main dwelling													
Internal Wall 1					85.0000		9.0000	765.0000	(32c)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =							12548.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													135.7161 (35)
Thermal bridges (Default value 0.200 * total exposed area)													59.2800 (36)
Point Thermal bridges													(36a) = 0.0000
Total fabric heat loss						(33) + (36) + (36a) =							156.1604 (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	84.3760	79.1156	77.4085	69.4487	69.4487	65.1332	66.5333	63.7714	66.5333	70.9640	72.5176	77.4085 (38)	
Heat transfer coeff	240.5365	235.2760	233.5689	225.6091	225.6091	221.2936	222.6937	219.9318	222.6937	227.1244	228.6780	233.5689 (39)	
Average = Sum(39)m / 12 =												228.0486	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.6015	2.5446	2.5262	2.4401	2.4401	2.3934	2.4085	2.3787	2.4085	2.4565	2.4733	2.5262 (40)	
HLP (average)	2.4665												
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6579 (42)
Hot water usage for mixer showers	68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207 (42a)
Hot water usage for baths	31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603 (42b)
Hot water usage for other uses	44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523 (42c)
Average daily hot water use (litres/day)												132.4529 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334 (44)
Energy content (annual)	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)
Distribution loss (46)m = 0.15 x (45)m	34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578 (46)
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5900 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.2402 (55)
Total storage loss	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (56)
If cylinder contains dedicated solar storage	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
Total per year (kWh/year) = Sum(64)m =												3174.2434 (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)

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Heat gains from water heating, kWh/month
 119.7704 106.4004 114.0215 102.3493 100.6964 67.8664 66.8879 69.5797 70.3876 103.8817 108.1952 118.7158 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	(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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)
Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642	(72)
Total internal gains	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010	(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

Northeast				2.0000	13.7622		0.7600		0.7000		0.7700		10.1476 (75)
Southeast				11.3400	42.6275		0.7600		0.7000		0.7700		178.2166 (77)
Southwest				6.1600	42.6275		0.7600		0.7000		0.7700		96.8090 (79)
Northwest				3.3600	13.7622		0.7600		0.7000		0.7700		17.0479 (81)

Solar gains	302.2212	465.9367	657.9217	900.6632	1006.9278	1085.8065	1027.5834	922.6208	776.7553	557.1617	367.1952	249.1126	(83)
Total gains	964.5139	1125.8798	1298.1278	1504.0801	1573.7055	1585.5141	1507.7611	1406.1183	1279.1501	1127.1080	977.6186	894.8137	(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	14.4911	14.8151	14.9234	15.4499	15.4499	15.7512	15.6522	15.8487	15.6522	15.3468	15.2426	14.9234	
alpha	1.9661	1.9877	1.9949	2.0300	2.0300	2.0501	2.0435	2.0566	2.0435	2.0231	2.0162	1.9949	
util living area	0.9498	0.9318	0.8970	0.8281	0.7299	0.5867	0.4515	0.4622	0.6860	0.8461	0.9252	0.9545	(86)
Living	18.0255	18.2959	18.8131	19.5078	20.1074	20.5411	20.7301	20.7313	20.3917	19.7008	18.8280	18.0762	
Non living	15.7767	16.1238	16.7647	17.6234	18.3044	18.7459	18.8647	18.8849	18.6284	17.8726	16.8125	15.8598	
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	19.4798	18.2959	18.8131	19.5078	20.1074	20.5411	20.7301	20.7313	20.3917	19.7008	18.8280	18.4855	(87)
Th 2	18.9625	18.9950	19.0056	19.0561	19.0561	19.0840	19.0749	19.0928	19.0749	19.0464	19.0365	19.0056	(88)
util rest of house	0.9371	0.9149	0.8701	0.7808	0.6437	0.4406	0.2365	0.2382	0.5517	0.7887	0.9026	0.9428	(89)
MIT 2	17.6772	16.1238	16.7647	17.6234	18.3044	18.7459	18.8647	18.8849	18.6284	17.8726	16.8125	16.4219	(90)
Living area fraction	18.4851	17.0973	17.6828	18.4680	19.1125	19.5505	19.7007	19.7124	19.4187	18.6920	17.7159	17.3468	(91)
MIT	18.4851	17.0973	17.6828	18.4680	19.1125	19.5505	19.7007	19.7124	19.4187	18.6920	17.7159	17.3468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4851	17.0973	17.6828	18.4680	19.1125	19.5505	19.7007	19.7124	19.4187	18.6920	17.7159	17.3468	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9334	0.8926	0.8463	0.7629	0.6467	0.4811	0.3141	0.3195	0.5804	0.7752	0.8814	0.9293	(94)
Useful gains	900.3154	1004.9303	1098.5625	1147.4670	1017.7367	762.8694	473.6394	449.2410	742.4640	873.7439	861.6319	831.5185	(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	3243.6629	2752.0958	2471.8071	2023.2556	1469.2791	918.4784	512.3573	486.5816	984.0131	1588.0520	2198.9340	2837.1115	(97)
Space heating kWh	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612	(98a)
Space heating requirement - total per year (kWh/year)												7892.2189	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7892.2189	
Space heating per m ²										(98c) / (4) =		85.3582	(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 %)													371.3077 (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	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612	(98)
Space heating efficiency (main heating system 1)	371.3077	371.3077	371.3077	371.3077	371.3077	0.0000	0.0000	0.0000	0.0000	371.3077	371.3077	371.3077	(210)

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Space heating fuel (main heating system)	469.5433	316.2054	275.1610	169.8235	90.4768	0.0000	0.0000	0.0000	0.0000	143.1280	259.3152	401.8665	(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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(64)
Efficiency of water heater	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	(216)
Fuel for water heating, kWh/month	175.7391	155.8073	166.2890	147.7837	144.3846	114.5969	113.0897	117.5146	118.7415	149.6208	157.3934	174.0056	(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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491	(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												2125.5197	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												182.9571	
Water heating fuel used												1734.9663	(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)												219.4653	(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												4079.9513	(238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2125.5197	27.6700	588.1313 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1734.9663	27.6700	480.0652 (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	219.4653	27.6700	60.7261 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1128.9225 (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	2125.5197	0.1551	329.5820 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1734.9663	0.1416	245.6391 (264)
Space and water heating			575.2211 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Total CO2, kg/year			606.8968 (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	2125.5197	1.5740	3345.6164 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1734.9663	1.5236	2643.3341 (278)
Space and water heating			5988.9505 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Total Primary energy kWh/year			6325.5737 (286)

SAP 10 EPC IMPROVEMENTS

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00001

Current energy efficiency rating:
Current environmental impact rating:

C 69
A 94

N Solar water heating
U Solar photovoltaic panels
V2 Wind turbine

Recommended
Recommended
Not applicable

Recommended measures:
N Solar water heating
U Solar photovoltaic panels

SAP change + 1.9
Cost change -£ 93
CO2 change -42 kg (6.9%)

SAP change + 6.4
Cost change -£ 268
CO2 change -131 kg (23.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£93	0.45 kg/m²	C 71 A 94
Solar photovoltaic panels	£268	1.42 kg/m²	C 78 A 95
Total Savings	£361	1.87 kg/m²	

Potential energy efficiency rating: C 78
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1129	£1036	£93
Space heating	£588	£610	-£22
Water heating	£480	£365	£115
Lighting	£61	£61	£0
Generated (PV)	-£0	-£268	£268
Total cost of fuels	£1129	£768	£361
Total cost of uses	£1129	£768	£361
Delivered energy	44 kWh/m²	30 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	7 kg/m²	5 kg/m²	2 kg/m²
Primary energy	68 kWh/m²	47 kWh/m²	21 kWh/m²

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

1. Overall dwelling characteristics

Main dwelling	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	244.0944 (5)

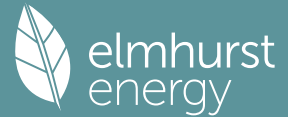
2. Ventilation rate

	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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1229 (8)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.8729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.8729 (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	1.1130	1.0911	1.0693	0.9602	0.9384	0.8293	0.8293	0.8074	0.8729	0.9384	0.9820	1.0257 (22b)
Effective ac	1.1130	1.0911	1.0693	0.9610	0.9403	0.8438	0.8438	0.8260	0.8810	0.9403	0.9822	1.0257 (25)

3. Heat losses and heat loss parameter

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Element			Gross		Openings		NetArea		U-value		A x U		K-value		A x K
Main dwelling			m2		m2		m2		W/m2K		W/K		kJ/m2K		kJ/K
Opening Type 1							22.8600		1.3258		30.3068				(27)
Opening Type 2							1.8900		1.4000		2.6460				(26)
Heatloss Floor 1							92.4600		0.2500		23.1150		110.0000		10170.6000 (28a)
External Wall 1			111.4800		24.7500		86.7300		0.3000		26.0190		9.0000		780.5700 (29a)
External Roof 1			92.4600				92.4600		0.1600		14.7936		9.0000		832.1400 (30)
Total net area of external elements Aum(A, m2)							296.4000								(31)
Fabric heat loss, W/K = Sum (A x U)							(26)...(30) + (32) =				96.8804				(33)
Main dwelling															
Internal Wall 1							85.0000						9.0000		765.0000 (32c)
Heat capacity Cm = Sum(A x k)											(28)...(30) + (32) + (32a)...(32e) =		12548.3100		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K															135.7161 (35)
Thermal bridges (Default value 0.200 * total exposed area)															59.2800 (36)
Point Thermal bridges													(36a) =		0.0000
Total fabric heat loss											(33) + (36) + (36a) =				156.1604 (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			
	89.6495	87.8917	86.1339	77.4085	75.7398	67.9718	67.9718	66.5333	70.9640	75.7398	79.1156	82.6182			(38)
Heat transfer coeff	245.8100	244.0521	242.2943	233.5689	231.9003	224.1323	224.1323	222.6937	227.1244	231.9003	235.2760	238.7786			(39)
Average = Sum(39)m / 12 =												233.4719			
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	2.6586	2.6395	2.6205	2.5262	2.5081	2.4241	2.4241	2.4085	2.4565	2.5081	2.5446	2.5825			(40)
HLP (average)												2.5251			
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31			

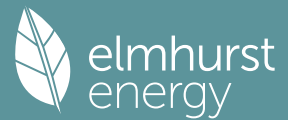
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579	(42)
Hot water usage for mixer showers	68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207	(42a)	
Hot water usage for baths	31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603	(42b)	
Hot water usage for other uses	44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523	(42c)	
Average daily hot water use (litres/day)													132.4529	(43)
Daily hot water use	Jan 144.1027	Feb 141.0027	Mar 137.2406	Apr 131.5510	May 126.9195	Jun 121.9447	Jul 120.0558	Aug 123.8019	Sep 127.7495	Oct 132.9692	Nov 138.7455	Dec 143.7334	(44)	
Energy conte	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518	(45)	
Energy content (annual)										Total = Sum(45)m =		2200.0088		
Distribution loss (46)m = 0.15 x (45)m	34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578	(46)	
Water storage loss (or HIU loss):													150.0000	(47)
Store volume													1.5900	(48)
a) If manufacturer declared loss factor is known (kWh/day):													0.7800	(49)
Temperature factor from Table 2b													1.2402	(55)
Enter (49) or (54) in (55)														
Total storage loss	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(56)	
If cylinder contains dedicated solar storage	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(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													645.1074	(H24)
Heat delivered to space heating													0.0000	(H29)
Solar input													645.1074	
Solar input	-0.0000	-16.1750	-59.5669	-83.4342	-111.6103	-100.3478	-99.8737	-86.5100	-58.7154	-28.8741	-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	321.5272	268.8854	244.6706	186.9465	152.5515	109.3154	107.0319	128.4913	158.5305	244.8677	287.9624	318.3556	(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	119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158	(65)	

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

Metabolic gains (Table 5), Watts														
(66)m	Jan 159.4750	Feb 159.4750	Mar 159.4750	Apr 159.4750	May 159.4750	Jun 159.4750	Jul 159.4750	Aug 159.4750	Sep 159.4750	Oct 159.4750	Nov 159.4750	Dec 159.4750	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	(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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)	
Water heating gains (Table 5)														

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Total internal gains	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010 (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	
Northeast	2.0000		11.2829		0.7600		0.7000		0.7700		8.3195 (75)	
Southeast	11.3400		36.7938		0.7600		0.7000		0.7700		153.8271 (77)	
Southwest	6.1600		36.7938		0.7600		0.7000		0.7700		83.5604 (79)	
Northwest	3.3600		11.2829		0.7600		0.7000		0.7700		13.9768 (81)	
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625 (83)
Total gains	921.9765	1109.6866	1275.2363	1423.2223	1515.1237	1454.4338	1395.1265	1300.5254	1201.0963	1072.3126	922.8135	867.0636 (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	14.1802	14.2824	14.3860	14.9234	15.0308	15.5517	15.5517	15.6522	15.3468	15.0308	14.8151	14.5978
alpha	1.9453	1.9522	1.9591	1.9949	2.0021	2.0368	2.0368	2.0435	2.0231	2.0021	1.9877	1.9732
util living area	0.9570	0.9377	0.9079	0.8551	0.7755	0.6661	0.5499	0.5888	0.7532	0.8798	0.9406	0.9614 (86)
Living	17.7819	18.0888	18.5890	19.2754	19.8854	20.3857	20.6321	20.5921	20.1928	19.4081	18.5089	17.7777
Non living	15.4595	15.8430	16.4641	17.3229	18.0386	18.6028	18.8073	18.7935	18.4183	17.5109	16.3978	15.4717
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	19.3561	18.0888	18.5890	19.2754	19.8854	20.3857	20.6321	20.5921	20.1928	19.4081	18.5089	18.2290 (87)
Th 2	18.9304	18.9411	18.9517	19.0056	19.0161	19.0656	19.0656	19.0749	19.0464	19.0161	18.9950	18.9733 (88)
util rest of house	0.9464	0.9224	0.8841	0.8145	0.7038	0.5404	0.3575	0.4025	0.6466	0.8372	0.9233	0.9519 (89)
MIT 2	17.5287	15.8430	16.4641	17.3229	18.0386	18.6028	18.8073	18.7935	18.4183	17.5109	16.3978	16.0969 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.3477	16.8495	17.4165	18.1980	18.8663	19.4019	19.6252	19.5997	19.2136	18.3612	17.3440	17.0525 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3477	16.8495	17.4165	18.1980	18.8663	19.4019	19.6252	19.5997	19.2136	18.3612	17.3440	17.0525 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9427	0.9003	0.8598	0.7934	0.6972	0.5661	0.4213	0.4616	0.6579	0.8183	0.9029	0.9393 (94)
Useful gains	869.1111	999.0613	1096.4244	1129.1553	1056.3488	823.3689	587.7923	600.3631	790.2200	877.4544	833.2464	814.4664 (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	3453.0665	2916.3112	2645.0023	2171.7238	1661.8766	1076.2602	678.0458	712.5425	1161.4254	1799.8194	2410.1692	3068.8947 (97)
Space heating kWh	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98a)
Space heating requirement - total per year (kWh/year)												9063.0775
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	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9063.0775
Space heating per m2												(98c) / (4) = 98.0216 (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 %)												373.0357 (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	1922.4628	1288.3920	1152.1420	750.6493	450.5127	0.0000	0.0000	0.0000	0.0000	686.2396	1135.3844	1677.2946 (98)
Space heating efficiency (main heating system 1)	373.0357	373.0357	373.0357	373.0357	373.0357	0.0000	0.0000	0.0000	0.0000	373.0357	373.0357	373.0357 (210)
Space heating fuel (main heating system)	515.3563	345.3804	308.8557	201.2272	120.7693	0.0000	0.0000	0.0000	0.0000	183.9608	304.3635	449.6338 (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	321.5272	268.8854	244.6706	186.9465	152.5515	109.3154	107.0319	128.4913	158.5305	244.8677	287.9624	318.3556 (64)
Efficiency of water heater	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873 (216)
(217)m	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873	182.9873 (217)
Fuel for water heating, kWh/month	175.7101	146.9421	133.7090	102.1636	83.3673	59.7393	58.4914	70.2187	86.6347	133.8167	157.3674	173.9768 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-40.1586	-60.2464	-91.8198	-106.8681	-114.7001	-94.2181	-92.9091	-87.6632	-77.3860	-69.4897	-44.7978	-33.9682 (233a)

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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	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	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	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	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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													2429.5471	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													182.9873	
Water heating fuel used													1382.1371	(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)													219.4653	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-914.2250	(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													3196.9245	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2429.5471	16.4900	400.6323	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1382.1371	16.4900	227.9144	(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	219.4653	16.4900	36.1898	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-914.2250	16.4900	-150.7557	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-150.7557	(252)
Total energy cost			527.1729	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.3806	(257)
SAP value		77.6199	
SAP rating (Section 12)		78	(258)
SAP band		C	

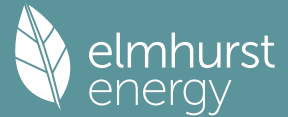
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2429.5471	0.1546	375.5038	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1382.1371	0.1452	200.6378	(264)
Space and water heating			576.1416	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	219.4653	0.1443	31.6756	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-914.2250	0.1349	-123.2866	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-123.2866	(269)
Total CO2, kg/year			495.6276	(272)
CO2 emissions per m2			5.3600	(273)
EI value			95.1685	
EI rating			95	(274)
EI band			A	

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

1. Overall dwelling characteristics

Full SAP Calculation Printout



Main dwelling		Area (m2)	Storey height (m)	Volume (m3)	
Ground floor		92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600				(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.0944 (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										3 * 10 =	30.0000 (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
Pressure test										30.0000 / (5) =	0.1229 (8)
Pressure Test Method										No	
Measured/design AP50										Blower Door	15.0000 (17)
Infiltration rate											0.8729 (18)
Number of sides sheltered											0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.8729 (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													
	1.0475	0.9820	0.9602	0.8511	0.8511	0.7856	0.8074	0.7638	0.8074	0.8729	0.8947	0.9602	(22b)
Effective ac	1.0475	0.9822	0.9610	0.8622	0.8622	0.8086	0.8260	0.7917	0.8260	0.8810	0.9003	0.9610	(25)

3. Heat losses and heat loss parameter

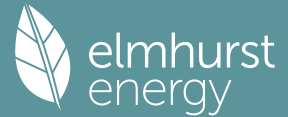
Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K						
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K						
Opening Type 1			22.8600	1.3258	30.3068			(27)					
Opening Type 2			1.8900	1.4000	2.6460			(26)					
Heatloss Floor 1			92.4600	0.2500	23.1150	110.0000	10170.6000	(28a)					
External Wall 1	111.4800	24.7500	86.7300	0.3000	26.0190	9.0000	780.5700	(29a)					
External Roof 1	92.4600		92.4600	0.1600	14.7936	9.0000	832.1400	(30)					
Total net area of external elements Aum(A, m2)			296.4000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	96.8804			(33)					
Main dwelling													
Internal Wall 1			85.0000			9.0000	765.0000	(32c)					
Heat capacity Cm = Sum(A x k)						(28)... (30) + (32) + (32a)... (32e) =	12548.3100	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.7161	(35)					
Thermal bridges (Default value 0.200 * total exposed area)							59.2800	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	156.1604	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	84.3760	79.1156	77.4085	69.4487	69.4487	65.1332	66.5333	63.7714	66.5333	70.9640	72.5176	77.4085	(38)
	240.5365	235.2760	233.5689	225.6091	225.6091	221.2936	222.6937	219.9318	222.6937	227.1244	228.6780	233.5689	(39)
Average = Sum(39)m / 12 =												228.0486	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	2.6015	2.5446	2.5262	2.4401	2.4401	2.3934	2.4085	2.3787	2.4085	2.4565	2.4733	2.5262	(40)
HLP (average)												2.4665	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579 (42)
Hot water usage for mixer showers	68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207 (42a)	
Hot water usage for baths	31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603 (42b)	
Hot water usage for other uses	44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523 (42c)	
Average daily hot water use (litres/day)												132.4529 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334 (44)	
Energy content (annual)	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2200.0088	
	34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578 (46)	
Water storage loss (or HIU loss):													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.5900 (48)	
Temperature factor from Table 2b												0.7800 (49)	
Enter (49) or (54) in (55)												1.2402 (55)	
Total storage loss													
	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (56)	
If cylinder contains dedicated solar storage													
	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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)	

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Total heat required for water heating calculated for each month												
	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (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												758.1212 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												758.1212
Solar input	-0.1956	-19.9561	-65.5808	-96.7642	-121.7637	-117.4000	-115.4986	-102.9833	-71.6268	-40.0558	-6.2963	-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	321.3316	265.1042	238.6567	173.6166	142.3981	92.2632	91.4071	112.0179	145.6191	233.6859	281.6662	318.3556 (64)
Total per year (kWh/year) = Sum(64)m =												2416.1222 (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												
	119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158 (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	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054 (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)												
	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Water heating gains (Table 5)												
	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
Total internal gains	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010 (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	
Northeast			2.0000		13.7622		0.7600		0.7000		0.7700	10.1476 (75)
Southeast			11.3400		42.6275		0.7600		0.7000		0.7700	178.2166 (77)
Southwest			6.1600		42.6275		0.7600		0.7000		0.7700	96.8090 (79)
Northwest			3.3600		13.7622		0.7600		0.7000		0.7700	17.0479 (81)

Solar gains	302.2212	465.9367	657.9217	900.6632	1006.9278	1085.8065	1027.5834	922.6208	776.7553	557.1617	367.1952	249.1126 (83)
Total gains	964.5139	1125.8798	1298.1278	1504.0801	1573.7055	1585.5141	1507.7611	1406.1183	1279.1501	1127.1080	977.6186	894.8137 (84)

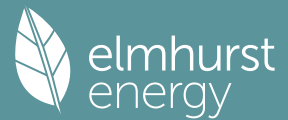
7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	14.4911	14.8151	14.9234	15.4499	15.4499	15.7512	15.6522	15.8487	15.6522	15.3468	15.2426	14.9234
alpha	1.9661	1.9877	1.9949	2.0300	2.0300	2.0501	2.0435	2.0566	2.0435	2.0231	2.0162	1.9949
util living area	0.9498	0.9318	0.8970	0.8281	0.7299	0.5867	0.4515	0.4622	0.6860	0.8461	0.9252	0.9545 (86)
Living	18.0255	18.2959	18.8131	19.5078	20.1074	20.5411	20.7301	20.7313	20.3917	19.7008	18.8280	18.0762
Non living	15.7767	16.1238	16.7647	17.6234	18.3044	18.7459	18.8647	18.8849	18.6284	17.8726	16.8125	15.8598
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	19.4798	18.2959	18.8131	19.5078	20.1074	20.5411	20.7301	20.7313	20.3917	19.7008	18.8280	18.4855 (87)
Th 2	18.9625	18.9950	19.0056	19.0561	19.0561	19.0840	19.0749	19.0928	19.0749	19.0464	19.0365	19.0056 (88)
util rest of house												
	0.9371	0.9149	0.8701	0.7808	0.6437	0.4406	0.2365	0.2382	0.5517	0.7887	0.9026	0.9428 (89)
MIT 2	17.6772	16.1238	16.7647	17.6234	18.3044	18.7459	18.8647	18.8849	18.6284	17.8726	16.8125	16.4219 (90)
Living area fraction									fLA = Living area / (4) =			0.4482 (91)
MIT	18.4851	17.0973	17.6828	18.4680	19.1125	19.5505	19.7007	19.7124	19.4187	18.6920	17.7159	17.3468 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4851	17.0973	17.6828	18.4680	19.1125	19.5505	19.7007	19.7124	19.4187	18.6920	17.7159	17.3468 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9334	0.8926	0.8463	0.7629	0.6467	0.4811	0.3141	0.3195	0.5804	0.7752	0.8814	0.9293 (94)
Useful gains	900.3154	1004.9303	1098.5625	1147.4670	1017.7367	762.8694	473.6394	449.2410	742.4640	873.7439	861.6319	831.5185 (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	3243.6629	2752.0958	2471.8071	2023.2556	1469.2791	918.4784	512.3573	486.5816	984.0131	1588.0520	2198.9340	2837.1115 (97)

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Space heating kWh	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612 (98a)
Space heating requirement - total per year (kWh/year)												7892.2189
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7892.2189
Space heating per m2										(98c) / (4) =		85.3582 (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 %)												371.3077 (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	1743.4506	1174.0952	1021.6939	630.5678	335.9475	0.0000	0.0000	0.0000	0.0000	531.4452	962.8575	1492.1612 (98)
Space heating efficiency (main heating system 1)	371.3077	371.3077	371.3077	371.3077	371.3077	0.0000	0.0000	0.0000	0.0000	371.3077	371.3077	371.3077 (210)
Space heating fuel (main heating system)	469.5433	316.2054	275.1610	169.8235	90.4768	0.0000	0.0000	0.0000	0.0000	143.1280	259.3152	401.8665 (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	321.3316	265.1042	238.6567	173.6166	142.3981	92.2632	91.4071	112.0179	145.6191	233.6859	281.6662	318.3556 (64)
Efficiency of water heater	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571	182.9571 (216)
Fuel for water heating, kWh/month	175.6322	144.8997	130.4441	94.8947	77.8314	50.4289	49.9610	61.2263	79.5919	127.7272	153.9521	174.0056 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-46.4363	-62.6113	-94.4818	-112.4782	-115.8933	-99.4102	-97.5599	-93.0810	-82.7829	-74.8796	-51.6876	-38.1453 (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												2125.5197 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.9571
Water heating fuel used												1320.5952 (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)												219.4653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-969.4474 (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												2776.1328 (238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2125.5197	27.6700	588.1313 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1320.5952	27.6700	365.4087 (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	219.4653	27.6700	60.7261 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-969.4474	27.6700	-268.2461
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-268.2461 (252)
Total energy cost			768.1559 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2125.5197	0.1551	329.5820 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1320.5952	0.1460	192.7589 (264)
Space and water heating			522.3409 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-969.4474	0.1350	-130.9140
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-130.9140 (269)
Total CO2, kg/year			434.1995 (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	2125.5197	1.5740	3345.6164 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1320.5952	1.5400	2033.6673 (278)
Space and water heating			5379.2836 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-969.4474	1.4991	-1453.3219
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1453.3219 (283)
Total Primary energy kWh/year			4383.6090 (286)

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Plot Reference	Slaugham Reduction				Issued on Date	29/07/2026	
Assessment Reference	00001			Plot Type Ref			
Plot Address					SAP Version	10.2	
SAP Rating	82 B		DER	3.52		TER	
Environmental	97 A		% DER < TER				N/A
CO ₂ Emissions (t/year)	0.26		DFEE	76.25		TFEE	
Compliance Check	N/A		% DFEE < TFEE				
% DPER < TPER			DPER	44.32		TPER	
Assessor Details	Mr. Neil Vanson				Assessor ID	M057-0001	
Client							

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	244.0944 (5)

2. Ventilation rate

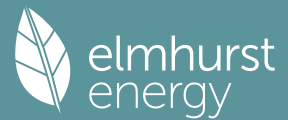
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1229 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382 (22b)
Effective ac	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Main dwelling												
Opening Type 1			22.8600	1.3258	30.3068		(27)					
Opening Type 2			1.8900	1.4000	2.6460		(26)					
Heatloss Floor 1			92.4600	0.1500	13.8690	110.0000	10170.6000 (28a)					
External Wall 1	111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700 (29a)					
External Roof 1	92.4600		92.4600	0.1500	13.8690	9.0000	832.1400 (30)					
Total net area of external elements Aum(A, m2)			296.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.2406		(33)					
Main dwelling												
Internal Wall 1			85.0000			9.0000	765.0000 (32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12548.3100 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.7161 (35)					
Thermal bridges (Default value 0.200 * total exposed area)							59.2800 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	142.5206 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.3800	Feb 49.0265	Mar 48.6800	Apr 47.0523	May 46.7478	Jun 45.3301	Jul 45.3301	Aug 45.0676	Sep 45.8762	Oct 46.7478	Nov 47.3638	Dec 48.0079 (38)
Heat transfer coeff												

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Average = Sum(39)m / 12 =	191.9007	191.5471	191.2006	189.5729	189.2684	187.8507	187.8507	187.5882	188.3968	189.2684	189.8844	190.5285 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.0755	2.0717	2.0679	2.0503	2.0470	2.0317	2.0317	2.0289	2.0376	2.0470	2.0537	2.0607 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	2.0503 (40)
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579 (42)
Hot water usage for mixer showers													
68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207	(42a)	
Hot water usage for baths													
31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603	(42b)	
Hot water usage for other uses													
44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523	(42c)	
Average daily hot water use (litres/day)												132.4529 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334	(44)	
Energy content (annual)	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)	
Energy content (annual)										Total = Sum(45)m =		2200.0088	
Distribution loss (46)m = 0.15 x (45)m													
34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578	(46)	
Water storage loss (or HIU loss):													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.5900 (48)	
Temperature factor from Table 2b												0.7800 (49)	
Enter (49) or (54) in (55)												1.2402 (55)	
Total storage loss													
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(56)	
If cylinder contains dedicated solar storage													
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(57)	
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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													
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(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													
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(64)	
12Total per year (kWh/year)												3174.2434 (64)	
Electric shower(s)												3174 (64)	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)	
Heat gains from water heating, kWh/month													
119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158	(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	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.8336	135.9944	122.8336	126.9281	122.8336	126.9281	122.8336	122.8336	126.9281	122.8336	126.9281	122.8336 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.5314	246.0585	239.6903	226.1332	209.0197	192.9355	182.1902	179.6631	186.0313	199.5885	216.7019	232.7861 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896 (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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
Total internal gains	590.2154	603.2555	578.6474	558.0817	530.0667	476.9912	457.7958	458.8866	473.5887	524.9168	556.7698	578.0527 (73)

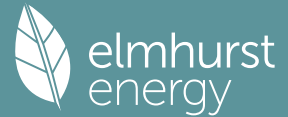
6. Solar gains

[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		
Northeast					2.0000	11.2829		0.7600	0.7000	0.7700	8.3195 (75)		
Southeast					11.3400	36.7938		0.7600	0.7000	0.7700	153.8271 (77)		
Southwest					6.1600	36.7938		0.7600	0.7000	0.7700	83.5604 (79)		
Northwest					3.3600	11.2829		0.7600	0.7000	0.7700	13.9768 (81)		
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625 (83)	
Total gains	849.8992	1052.9990	1213.6775	1377.8872	1478.4127	1431.7173	1372.7446	1275.9146	1172.2903	1027.2831	869.1598	799.4153 (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	18.1638	18.1973	18.2303	18.3868	18.4164	18.5554	18.5554	18.5813	18.5016	18.4164	18.3566	18.2946
alpha	2.2109	2.2132	2.2154	2.2258	2.2278	2.2370	2.2370	2.2388	2.2334	2.2278	2.2238	2.2196
util living area	0.9604	0.9369	0.9030	0.8408	0.7479	0.6289	0.5066	0.5493	0.7256	0.8720	0.9417	0.9651 (86)
Living	18.2892	18.6010	19.0534	19.6331	20.1536	20.5353	20.7211	20.6875	20.3753	19.7003	18.8916	18.2369

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Non living	16.2542	16.6453	17.2091	17.9213	18.5259	18.9339	19.0869	19.0697	18.7912	18.0255	17.0254	16.1938
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	19.6132	18.6010	19.0534	19.6331	20.1536	20.5353	20.7211	20.6875	20.3753	19.7003	18.8916	18.6234 (87)
Th 2	19.2835	19.2860	19.2884	19.3000	19.3022	19.3123	19.3123	19.3142	19.3084	19.3022	19.2978	19.2932 (88)
util rest of house	0.9514	0.9230	0.8807	0.8020	0.6808	0.5163	0.3447	0.3892	0.6274	0.8319	0.9262	0.9572 (89)
MIT 2	18.0741	16.6453	17.2091	17.9213	18.5259	18.9339	19.0869	19.0697	18.7912	18.0255	17.0254	16.7517 (90)
Living area fraction									FLA = Living area / (4) =			0.4482 (91)
MIT	18.7639	17.5218	18.0357	18.6885	19.2554	19.6516	19.8193	19.7948	19.5012	18.7761	17.8618	17.5906 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7639	17.5218	18.0357	18.6885	19.2554	19.6516	19.8193	19.7948	19.5012	18.7761	17.8618	17.5906 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9482	0.9036	0.8597	0.7850	0.6786	0.5418	0.3982	0.4401	0.6406	0.8160	0.9083	0.9465 (94)
Useful gains	805.8412	951.5324	1043.4110	1081.5771	1003.2855	775.6677	546.5913	561.5850	750.9853	838.2995	789.4708	756.6269 (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	2775.6330	2417.6788	2205.6372	1855.6388	1430.0060	948.9545	604.7539	636.8217	1017.5661	1547.4855	2043.5045	2551.2896 (97)
Space heating kWh	1465.5251	985.2504	864.6963	557.3244	317.4800	0.0000	0.0000	0.0000	0.0000	527.6344	902.9042	1335.2290 (98a)
Space heating requirement - total per year (kWh/year)												6956.0439
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	1465.5251	985.2504	864.6963	557.3244	317.4800	0.0000	0.0000	0.0000	0.0000	527.6344	902.9042	1335.2290 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6956.0439
Space heating per m2										(98c) / (4) =		75.2330 (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 %)												357.6958 (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	1465.5251	985.2504	864.6963	557.3244	317.4800	0.0000	0.0000	0.0000	0.0000	527.6344	902.9042	1335.2290 (98)
Space heating efficiency (main heating system 1)	357.6958	357.6958	357.6958	357.6958	357.6958	0.0000	0.0000	0.0000	0.0000	357.6958	357.6958	357.6958 (210)
Space heating fuel (main heating system)	409.7127	275.4436	241.7407	155.8096	88.7570	0.0000	0.0000	0.0000	0.0000	147.5092	252.4224	373.2862 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
Efficiency of water heater (217)m	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384 (216)
Fuel for water heating, kWh/month	176.0458	156.0791	166.5791	148.0416	144.6365	114.7969	113.2871	117.7196	118.9486	149.8818	157.6681	174.3092 (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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.5614	-63.4426	-99.0188	-117.6573	-128.8063	-110.2367	-108.6210	-100.7911	-86.3004	-73.9686	-46.6723	-35.0420 (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	-11.3363	-27.2402	-60.7863	-102.5938	-147.3183	-162.5735	-160.0425	-131.5019	-91.5650	-43.5166	-16.5725	-8.8730 (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												1944.6813 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.6384
Water heating fuel used												1737.9933 (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)												219.4653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1976.0385 (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												1926.1014 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1944.6813	0.1547	300.8598 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1737.9933	0.1416	246.0677 (264)
Space and water heating			546.9275 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1012.1185	0.1342	-135.8243
PV Unit electricity exported	-963.9200	0.1219	-117.5486
Total			-253.3729 (269)
Total CO2, kg/year			325.2302 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1944.6813	1.5727	3058.4400 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1737.9933	1.5236	2647.9459 (278)
Space and water heating			5706.3859 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1012.1185	1.4960	-1514.1030
PV Unit electricity exported	-963.9200	0.4474	-431.2310
Total			-1945.3340 (283)
Total Primary energy kWh/year			4097.6752 (286)
Dwelling Primary energy Rate (DPER)			44.3200 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 244.0944 (5)

2. Ventilation rate

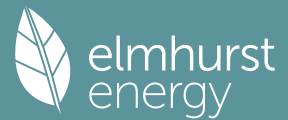
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1229 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			22.8600	1.3258	30.3068		(27)

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Opening Type 2				1.8900	1.4000	2.6460			(26)
Heatloss Floor 1				92.4600	0.1500	13.8690	110.0000	10170.6000	(28a)
External Wall 1		111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700	(29a)
External Roof 1		92.4600		92.4600	0.1500	13.8690	9.0000	832.1400	(30)
Total net area of external elements Aum(A, m2)				296.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		83.2406			(33)
Main dwelling									
Internal Wall 1				85.0000			9.0000	765.0000	(32c)
Heat capacity Cm = Sum(A x k)									
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									(28)...(30) + (32) + (32a)...(32e) = 12548.3100 (34)
Thermal bridges (Default value 0.200 * total exposed area)									135.7161 (35)
Point Thermal Bridges									59.2800 (36)
Total fabric heat loss									(36a) = 0.0000
									(33) + (36) + (36a) = 142.5206 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	49.3800	49.0265	48.6800	47.0523	46.7478	45.3301	45.3301	45.0676	45.8762	46.7478	47.3638	48.0079	(38)
Average = Sum(39)m / 12 =	191.9007	191.5471	191.2006	189.5729	189.2684	187.8507	187.8507	187.5882	188.3968	189.2684	189.8844	190.5285	(39)
												189.5715	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.0755	2.0717	2.0679	2.0503	2.0470	2.0317	2.0317	2.0289	2.0376	2.0470	2.0537	2.0607	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												2.0503	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579 (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													
	29.7027	29.2616	28.6404	27.4950	26.6374	25.6864	25.1727	25.7895	26.4612	27.4788	28.6477	29.6023	(42b)
Hot water usage for other uses													
	41.8497	40.3279	38.8061	37.2843	35.7625	34.2407	34.2407	35.7625	37.2843	38.8061	40.3279	41.8497	(42c)
Average daily hot water use (litres/day)													65.5843 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	71.5524	69.5895	67.4465	64.7793	62.3999	59.9271	59.4134	61.5520	63.7455	66.2849	68.9757	71.4520	(44)
Energy content (annual)	113.3216	99.0945	103.6628	88.6796	84.0022	73.6873	71.8553	76.2143	78.6046	89.9480	98.2685	111.8766	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss (or HIU loss):													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	96.3233	84.2304	88.1133	75.3777	71.4019	62.6342	61.0770	64.7821	66.8139	76.4558	83.5282	95.0951	(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													
	96.3233	84.2304	88.1133	75.3777	71.4019	62.6342	61.0770	64.7821	66.8139	76.4558	83.5282	95.0951	(64)
												925.8330	(64)
												926	(64)
12Total per year (kWh/year)													
Electric shower(s)													
	55.0848	49.0810	53.5945	51.1446	52.1043	49.7025	51.3592	52.1043	51.1446	53.5945	52.5868	55.0848	(64a)
												626.5858	(64a)
Heat gains from water heating, kWh/month													
	37.8520	33.3278	35.4270	31.6306	30.8765	28.0842	28.1091	29.2216	29.4896	32.5126	34.0287	37.5450	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	132.8958	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	122.8336	135.9944	122.8336	126.9281	122.8336	126.9281	122.8336	122.8336	126.9281	122.8336	126.9281	122.8336	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	243.5314	246.0585	239.6903	226.1332	209.0197	192.9355	182.1902	179.6631	186.0313	199.5885	216.7019	232.7861	(68)
Pumps, fans	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	36.2896	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)
Total internal gains	50.8764	49.5950	47.6169	43.9314	41.5007	39.0058	37.7810	39.2764	40.9578	43.6997	47.2621	50.4637	(72)
	480.1101	494.5166	473.0095	459.8613	436.2228	421.7381	405.6736	404.6419	416.7860	428.9905	453.7609	468.9522	(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
Northeast				2.0000	11.2829		0.7600		0.7000		0.7700		8.3195 (75)
Southeast				11.3400	36.7938		0.7600		0.7000		0.7700		153.8271 (77)
Southwest				6.1600	36.7938		0.7600		0.7000		0.7700		83.5604 (79)
Northwest				3.3600	11.2829		0.7600		0.7000		0.7700		13.9768 (81)
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900		221.3625 (83)
Total gains	739.7939	944.2601	1108.0397	1279.6668	1384.5689	1376.4643	1320.6224	1221.6698	1115.4875	931.3569	766.1509		690.3147 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.1638	18.1973	18.2303	18.3868	18.4164	18.5554	18.5554	18.5813	18.5016	18.4164	18.3566	18.2946
alpha	2.2109	2.2132	2.2154	2.2258	2.2278	2.2370	2.2370	2.2388	2.2334	2.2278	2.2238	2.2196
util living area	0.9696	0.9483	0.9169	0.8577	0.7681	0.6432	0.5207	0.5654	0.7417	0.8908	0.9538	0.9738 (86)
MIT	17.4273	17.8539	18.4729	19.2720	19.9929	20.5402	20.7986	20.7500	20.3154	19.3538	18.2450	17.3558 (87)
Th 2	19.2835	19.2860	19.2884	19.3000	19.3022	19.3123	19.3123	19.3142	19.3084	19.3022	19.2978	19.2932 (88)
util rest of house	0.9626	0.9365	0.8972	0.8217	0.7034	0.5307	0.3563	0.4034	0.6454	0.8549	0.9412	0.9677 (89)
MIT 2	16.1764	16.5959	17.2008	17.9709	18.6299	19.0878	19.2558	19.2359	18.9299	18.0722	16.9954	16.1116 (90)
Living area fraction	16.7370	17.1597	17.7709	18.5541	19.2408	19.7388	19.9472	19.9145	19.5508	18.6466	17.5555	16.4482 (91)
MIT	16.7370	17.1597	17.7709	18.5541	19.2408	19.7388	19.9472	19.9145	19.5508	18.6466	17.5555	16.6692 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7370	17.1597	17.7709	18.5541	19.2408	19.7388	19.9472	19.9145	19.5508	18.6466	17.5555	16.6692 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9470	0.9159	0.8738	0.8019	0.7006	0.5626	0.4240	0.4674	0.6617	0.8367	0.9225	0.9535 (94)
Useful gains	700.5703	864.8367	968.2530	1026.1538	970.0222	774.4091	559.9180	571.0297	738.1311	779.2982	706.7722	658.1958 (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	2386.6716	2348.3187	2155.0102	1830.1470	1427.2378	965.3207	628.7819	659.2850	1026.9190	1522.9718	1985.3274	2375.7413 (97)
Space heating kWh	1254.4593	996.8999	882.9473	578.8751	340.1684	0.0000	0.0000	0.0000	0.0000	553.2932	920.5597	1277.8538 (98a)
Space heating requirement - total per year (kWh/year)												6805.0568
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	1254.4593	996.8999	882.9473	578.8751	340.1684	0.0000	0.0000	0.0000	0.0000	553.2932	920.5597	1277.8538 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6805.0568
Space heating per m2										(98c) / (4) =		73.6000 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	1765.7969	1390.0954	1425.6703	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6474	0.7164	0.6810	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1143.1428	995.8245	970.8683	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1560.3941	1497.5042	1384.2568	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	300.4210	373.2497	307.5610	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	75.1052	93.3124	76.8903	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												245.3079 (107)
Energy for space heating												73.6000 (99)
Energy for space cooling												2.6531 (108)
Total												76.2531 (109)
Fabric Energy Efficiency (DFEE)												76.3 (109)

SAP 10 WORKSHEET FOR Conversion (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

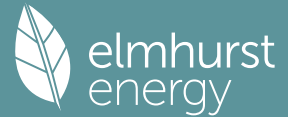
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 244.0944 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)

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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
30.0000 / (5) = 0.1229 (8)

Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Yes
Blower Door
5.0000 (17)
0.3729 (18)
0 (19)

Shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)

Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3729 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4755	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382 (22b)
Effective ac	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			22.8600	1.3258	30.3068		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			92.4600	0.1500	13.8690	110.0000	10170.6000 (28a)
External Wall 1	111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700 (29a)
External Roof 1	92.4600		92.4600	0.1500	13.8690	9.0000	832.1400 (30)
Total net area of external elements Aum(A, m2)			296.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.2406		(33)
Main dwelling							
Internal Wall 1			85.0000			9.0000	765.0000 (32c)

Heat capacity Cm = Sum(A x k)

(28)...(30) + (32) + (32a)...(32e) = 12548.3100 (34)

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

135.7161 (35)

Thermal bridges (Default value 0.200 * total exposed area)

59.2800 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 142.5206 (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	49.3800	49.0265	48.6800	47.0523	46.7478	45.3301	45.3301	45.0676	45.8762	46.7478	47.3638	48.0079 (38)
Heat transfer coeff	191.9007	191.5471	191.2006	189.5729	189.2684	187.8507	187.8507	187.5882	188.3968	189.2684	189.8844	190.5285 (39)
Average = Sum(39)m / 12 =												189.5715

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.0755	2.0717	2.0679	2.0503	2.0470	2.0317	2.0317	2.0289	2.0376	2.0470	2.0537	2.0607 (40)
HLP (average)												2.0503
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

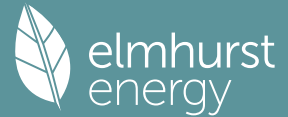
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6579 (42)
Hot water usage for mixer showers	68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207 (42a)
Hot water usage for baths	31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603 (42b)
Hot water usage for other uses	44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523 (42c)
Average daily hot water use (litres/day)												132.4529 (43)
Daily hot water use	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334 (44)
Energy conte	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)
Energy content (annual)										Total = Sum(45)m =		2200.0088
Distribution loss (46)m = 0.15 x (45)m	34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578 (46)
Water storage loss (or HIU loss):												150.0000 (47)
Store volume												1.5900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.2402 (55)
Enter (49) or (54) in (55)												
Total storage loss	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (56)
If cylinder contains dedicated solar storage	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (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	119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
----------------------------------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(66)m	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	(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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)
Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642	(72)
Total internal gains	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010	(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
Northeast					2.0000	11.2829	0.7600	0.7000	0.7700			8.3195 (75)
Southeast					11.3400	36.7938	0.7600	0.7000	0.7700			153.8271 (77)
Southwest					6.1600	36.7938	0.7600	0.7000	0.7700			83.5604 (79)
Northwest					3.3600	11.2829	0.7600	0.7000	0.7700			13.9768 (81)
Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625 (83)
Total gains	921.9765	1109.6866	1275.2363	1423.2223	1515.1237	1454.4338	1395.1265	1300.5254	1201.0963	1072.3126	922.8135	867.0636 (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	18.1638	18.1973	18.2303	18.3868	18.4164	18.5554	18.5554	18.5813	18.5016	18.4164	18.3566	18.2946
alpha	2.2109	2.2132	2.2154	2.2258	2.2278	2.2370	2.2370	2.2388	2.2334	2.2278	2.2238	2.2196
util living area	0.9538	0.9307	0.8947	0.8330	0.7401	0.6232	0.5007	0.5423	0.7176	0.8631	0.9350	0.9592 (86)
Living	18.3572	18.6509	19.1019	19.6624	20.1706	20.5418	20.7245	20.6922	20.3876	19.7325	18.9397	18.3020
Non living	16.3389	16.7063	17.2669	17.9540	18.5425	18.9386	19.0883	19.0720	18.8015	18.0615	17.0839	16.2750
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	19.6481	18.6509	19.1019	19.6624	20.1706	20.5418	20.7245	20.6922	20.3876	19.7325	18.9397	18.6794 (87)
Th 2	19.2835	19.2860	19.2884	19.3000	19.3022	19.3123	19.3123	19.3142	19.3084	19.3022	19.2978	19.2932 (88)
util rest of house	0.9436	0.9157	0.8710	0.7930	0.6722	0.5105	0.3399	0.3831	0.6186	0.8211	0.9181	0.9502 (89)
MIT 2	18.1079	16.7063	17.2669	17.9540	18.5425	18.9386	19.0883	19.0720	18.8015	18.0615	17.0839	16.8183 (90)
Living area fraction	18.7982	17.5779	18.0893	18.7197	19.2722	19.6571	19.8217	19.7982	19.5124	18.8104	17.9156	17.6524 (92)
MIT	18.7982	17.5779	18.0893	18.7197	19.2722	19.6571	19.8217	19.7982	19.5124	18.8104	17.9156	17.6524 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7982	17.5779	18.0893	18.7197	19.2722	19.6571	19.8217	19.7982	19.5124	18.8104	17.9156	17.6524 (93)

8. Space heating requirement

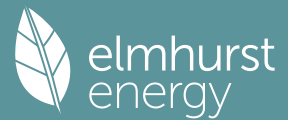
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9401	0.8956	0.8498	0.7764	0.6708	0.5364	0.3932	0.4339	0.6326	0.8057	0.8994	0.9384 (94)
Ext temp.	866.7572	993.8472	1083.6356	1105.0310	1016.3355	780.1305	548.4956	564.3323	759.7763	863.9625	829.9901	813.6847 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2782.2068	2428.4108	2215.8858	1861.5407	1433.1837	949.9872	605.1926	637.4539	1019.6750	1553.9682	2053.7206	2563.0733 (97)
Space heating requirement - total per year (kWh/year)	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6782.3327 (98c) / (4) =
Space heating per m2												73.3542 (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 %)	357.6958 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451 (98)
Space heating fuel (main heating system)	357.6958	357.6958	357.6958	357.6958	357.6958	0.0000	0.0000	0.0000	0.0000	357.6958	357.6958	357.6958 (210)
Space heating efficiency (main heating system 2)	398.4096	269.5102	235.5057	152.2766	86.7036	0.0000	0.0000	0.0000	0.0000	143.5198	246.3227	363.8693 (211)
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 (212)
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 (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

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Efficiency of water heater	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
(217)m	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384 (216)
Fuel for water heating, kWh/month	176.0458	156.0791	166.5791	148.0416	144.6365	114.7969	113.2871	117.7196	118.9486	149.8818	157.6681	174.3092 (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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-41.4966	-63.3461	-98.8056	-117.4263	-128.5974	-110.2367	-108.6210	-100.7911	-86.3004	-73.8434	-46.6075	-34.9970 (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	-11.4011	-27.3367	-60.9996	-102.8248	-147.5271	-162.5735	-160.0425	-131.5019	-91.5650	-43.6419	-16.6374	-8.9180 (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												1896.1174 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.6384
Water heating fuel used												1737.9933 (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)												219.4653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1976.0385 (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												1877.5375 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1896.1174	16.4900	312.6698 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1737.9933	16.4900	286.5951 (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	219.4653	16.4900	36.1898 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1011.0691	16.4900	-166.7253
PV Unit electricity exported	-964.9693	5.5900	-53.9418
Total			-220.6671 (252)
Total energy cost			414.7876 (255)

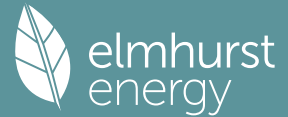
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0863 (257)
SAP value		82.3910
SAP rating (Section 12)		82 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1896.1174	0.1547	293.3393 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1737.9933	0.1416	246.0677 (264)
Space and water heating			539.4070 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1011.0691	0.1342	-135.6709
PV Unit electricity exported	-964.9693	0.1220	-117.7164
Total			-253.3873 (269)
Total CO2, kg/year			317.6953 (272)
CO2 emissions per m2			3.4400 (273)
EI value			96.9030
EI rating			97 (274)
EI band			A

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 244.0944 (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	3 * 10 =	30.0000 (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) =		30.0000 / (5) = 0.1229 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3729	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3729 (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	0.4475	0.4195	0.4102	0.3636	0.3636	0.3356	0.3449	0.3263	0.3449	0.3729	0.3822	0.4102 (22b)
Effective ac	0.6001	0.5880	0.5841	0.5661	0.5661	0.5563	0.5595	0.5532	0.5595	0.5695	0.5730	0.5841 (25)

3. Heat losses and heat loss parameter

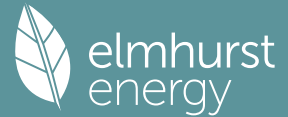
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			22.8600	1.3258	30.3068		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			92.4600	0.1500	13.8690	110.0000	10170.6000 (28a)
External Wall 1	111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700 (29a)
External Roof 1	92.4600		92.4600	0.1500	13.8690	9.0000	832.1400 (30)
Total net area of external elements Aum(A, m ²)			296.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.2406		(33)
Main dwelling							
Internal Wall 1			85.0000			9.0000	765.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12548.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.7161 (35)
Thermal bridges (Default value 0.200 * total exposed area)							59.2800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	142.5206 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.3404	47.3638	47.0523	45.5996	45.5996	44.8121	45.0676	44.5635	45.0676	45.8762	46.1597	47.0523 (38)
Heat transfer coeff	190.8611	189.8844	189.5729	188.1203	188.1203	187.3327	187.5882	187.0841	187.5882	188.3968	188.6803	189.5729 (39)
Average = Sum(39)m / 12 =												188.5668
HLP	2.0643	2.0537	2.0503	2.0346	2.0346	2.0261	2.0289	2.0234	2.0289	2.0376	2.0407	2.0503 (40)
HLP (average)												2.0394
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6579 (42)
Hot water usage for mixer showers												
68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207	(42a)
Hot water usage for baths												
31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603	(42b)
Hot water usage for other uses												
44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523	(42c)
Average daily hot water use (litres/day)												132.4529 (43)
Daily hot water use												
144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334	(44)
Energy conte	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)
Energy content (annual)												Total = Sum(45)m = 2200.0088
Distribution loss (46)m = 0.15 x (45)m												
34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578	(46)
Water storage loss (or HIU loss):												
Store volume												150.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):												1.5900 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.2402 (55)
Total storage loss												
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(56)
If cylinder contains dedicated solar storage												
38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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												
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(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												
321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(64)
Total per year (kWh/year) = Sum(64)m =											3174.2434	(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												
119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158	(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	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	(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)												
-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	(71)
Water heating gains (Table 5)												
160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642	(72)
Total internal gains												
662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010	(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			
Northeast					2.0000	13.7622		0.7600	0.7000		0.7700		10.1476 (75)	
Southeast					11.3400	42.6275		0.7600	0.7000		0.7700		178.2166 (77)	
Southwest					6.1600	42.6275		0.7600	0.7000		0.7700		96.8090 (79)	
Northwest					3.3600	13.7622		0.7600	0.7000		0.7700		17.0479 (81)	
Solar gains	302.2212	465.9367	657.9217	900.6632	1006.9278	1085.8065	1027.5834	922.6208	776.7553	557.1617	367.1952	249.1126	(83)	
Total gains	964.5139	1125.8798	1298.1278	1504.0801	1573.7055	1585.5141	1507.7611	1406.1183	1279.1501	1127.1080	977.6186	894.8137	(84)	

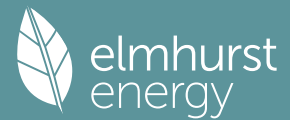
7. Mean internal temperature (heating season)

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	18.2627	18.3566	18.3868	18.5288	18.5288	18.6067	18.5813	18.6314	18.5813	18.5016	18.4738	18.3868
alpha	2.2175	2.2238	2.2258	2.2353	2.2353	2.2404	2.2388	2.2421	2.2388	2.2334	2.2316	2.2258
util living area												
0.9455	0.9245	0.8832	0.8044	0.6923	0.5414	0.4037	0.4167	0.6460	0.8247	0.9175	0.9514	(86)
Living	18.5495	18.7830	19.2503	19.8270	20.3301	20.6562	20.7912	20.7890	20.5381	19.9698	19.1946	18.5403
Non living	16.5854	16.8787	17.4566	18.1524	18.7185	19.0349	19.1241	19.1284	18.9470	18.3439	17.4064	16.5807
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	19.7464	18.7830	19.2503	19.8270	20.3301	20.6562	20.7912	20.7890	20.5381	19.9698	19.1946	18.8844 (87)
Th 2	19.2908	19.2978	19.3000	19.3104	19.3104	19.3160	19.3142	19.3178	19.3142	19.3084	19.3064	18.8844 (88)
util rest of house												
0.9332	0.9078	0.8564	0.7581	0.6120	0.4145	0.2308	0.2342	0.5248	0.7688	0.8952	0.9400	(89)
MIT 2	18.2109	16.8787	17.4566	18.1524	18.7185	19.0349	19.1241	19.1284	18.9470	18.3439	17.4064	17.0703 (90)
Living area fraction									fLA = Living area / (4) =			0.4482 (91)
MIT	18.8991	17.7322	18.2605	18.9030	19.4408	19.7615	19.8713	19.8727	19.6601	19.0726	18.2079	17.8834 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8991	17.7322	18.2605	18.9030	19.4408	19.7615	19.8713	19.8727	19.6601	19.0726	18.2079	17.8834 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9298	0.8875	0.8357	0.7448	0.6191	0.4513	0.2919	0.2990	0.5532	0.7592	0.8760	0.9274 (94)
Useful gains	896.7862	999.2253	1084.8912	1120.2355	974.2379	715.5426	440.1698	420.4297	707.6021	855.7498	856.3772	829.8917 (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												
	2652.7958	2341.6939	2115.7356	1768.8866	1286.8946	817.0552	463.5854	443.8860	874.1821	1388.9814	1907.1552	2404.4199 (97)
Space heating kWh												
	1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98a)
Space heating requirement - total per year (kWh/year)												5999.9371
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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1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											5999.9371
Space heating per m2											(98c) / (4) = 64.8922 (99)

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

Fraction of space heat from secondary/supplementary system (Table 1)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												357.3593 (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	1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98)
Space heating efficiency (main heating system 1)	357.3593	357.3593	357.3593	357.3593	357.3593	0.0000	0.0000	0.0000	0.0000	357.3593	357.3593	357.3593 (210)
Space heating fuel (main heating system)	365.5904	252.4459	214.6155	130.6889	65.0932	0.0000	0.0000	0.0000	0.0000	111.0155	211.7085	327.8071 (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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556 (64)
Efficiency of water heater	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233 (216)
Fuel for water heating, kWh/month	176.0603	156.0920	166.5929	148.0538	144.6484	114.8064	113.2964	117.7293	118.9585	149.8942	157.6811	174.3236 (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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-48.2621	-66.3584	-102.4702	-124.6952	-131.5734	-118.2250	-115.8280	-108.6098	-93.3088	-80.1947	-54.1172	-39.5629 (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	-15.0370	-30.1999	-67.0002	-120.9982	-164.0987	-193.8079	-187.9837	-156.9309	-108.4955	-53.5877	-22.3260	-11.2401 (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												1678.9649 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.6233
Water heating fuel used												1738.1368 (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)												219.4653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2214.9114 (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												1421.6557 (238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1678.9649	27.6700	464.5696 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1738.1368	27.6700	480.9425 (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	219.4653	27.6700	60.7261 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1083.2057	27.6700	-299.7230
PV Unit electricity exported	-1131.7057	5.8100	-65.7521
Total			-365.4751 (252)
Total energy cost			640.7630 (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	1678.9649	0.1552	260.5982 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1738.1368	0.1416	246.0880 (264)
Space and water heating			506.6862 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)

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Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1083.2057	0.1343	-145.4799
PV Unit electricity exported	-1131.7057	0.1218	-137.8414
Total			-283.3213 (269)
Total CO2, kg/year			255.0405 (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	1678.9649	1.5746	2643.6985 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1738.1368	1.5236	2648.1646 (278)
Space and water heating			5291.8630 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1083.2057	1.4964	-1620.8675
PV Unit electricity exported	-1131.7057	0.4468	-505.6264
Total			-2126.4939 (283)
Total Primary energy kWh/year			3501.9924 (286)

SAP 10 EPC IMPROVEMENTS

00001

Current energy efficiency rating: B 82
Current environmental impact rating: A 97

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 83	-41 kg (16.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£83 0.45 kg/m²	B 84	A 97
Total Savings	£83 0.45 kg/m²		
Potential energy efficiency rating:		B 84	
Potential environmental impact rating:			A 97

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1006	Potential £914	Saving £93
Electricity			
Space heating	£465	£487	-£22
Water heating	£481	£366	£115
Lighting	£61	£61	£0
Generated (PV)	-£365	-£356	-£10
Total cost of fuels	£641	£558	£83
Total cost of uses	£642	£558	£83
Delivered energy	15 kWh/m²	12 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	0 kg/m²
Primary energy	38 kWh/m²	33 kWh/m²	5 kWh/m²

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

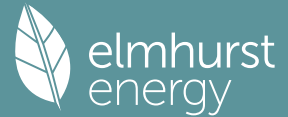
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling	92.4600 (1b)	2.6400 (2b)	244.0944 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		244.0944 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	244.0944 (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)

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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	3 * 10 =	30.0000 (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) =	30.0000 / (5) =	0.1229 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3729 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3729 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4755	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382	(22b)
	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960	(25)

3. Heat losses and heat loss parameter

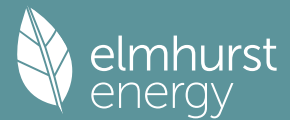
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			22.8600	1.3258	30.3068			(27)
Opening Type 2			1.8900	1.4000	2.6460			(26)
Heatloss Floor 1			92.4600	0.1500	13.8690	110.0000	10170.6000	(28a)
External Wall 1	111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700	(29a)
External Roof 1	92.4600		92.4600	0.1500	13.8690	9.0000	832.1400	(30)
Total net area of external elements Aum(A, m2)			296.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.2406			(33)
Main dwelling								
Internal Wall 1			85.0000			9.0000	765.0000	(32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12548.3100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.7161	(35)
Thermal bridges (Default value 0.200 * total exposed area)							59.2800	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	142.5206	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	49.3800	49.0265	48.6800	47.0523	46.7478	45.3301	45.3301	45.0676	45.8762	46.7478	47.3638	48.0079	(38)
Average = Sum(39)m / 12 =	191.9007	191.5471	191.2006	189.5729	189.2684	187.8507	187.8507	187.5882	188.3968	189.2684	189.8844	190.5285	(39)
												189.5715	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.0755	2.0717	2.0679	2.0503	2.0470	2.0317	2.0317	2.0289	2.0376	2.0470	2.0537	2.0607	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6579 (42)
Hot water usage for mixer showers	68.7843	67.7506	66.2443	63.3623	61.2354	58.8636	57.5154	59.0103	60.6490	63.1956	66.1396	68.5207	(42a)
Hot water usage for baths	31.2660	30.8017	30.1478	28.9421	28.0393	27.0383	26.4976	27.1469	27.8539	28.9250	30.1555	31.1603	(42b)
Hot water usage for other uses	44.0523	42.4504	40.8485	39.2466	37.6447	36.0428	36.0428	37.6447	39.2466	40.8485	42.4504	44.0523	(42c)
Average daily hot water use (litres/day)													132.4529 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334	(44)
Energy content (annual)	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518	(45)
Distribution loss (46)m = 0.15 x (45)m	34.2335	30.1179	31.6401	27.0130	25.6287	22.4918	21.7796	22.9939	23.6292	27.0657	29.6503	33.7578	(46)
Water storage loss (or HIU loss):													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5900 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.2402 (55)
Total storage loss	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(56)
If cylinder contains dedicated solar storage	38.4462	34.7256	38.4462	37.2060	38.4462	37.2060	38.4462	38.4462	37.2060	38.4462	37.2060	38.4462	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	52.5120	53.2624	54.8576	54.8576	53.0880	54.8576	54.8576	(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	321.5272	285.0604	304.2375	270.3808	264.1618	209.6632	206.9057	215.0012	217.2459	273.7417	287.9624	318.3556	(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)

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Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												645.1074 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												645.1074
Solar input	-0.0000	-16.1750	-59.5669	-83.4342	-111.6103	-100.3478	-99.8737	-86.5100	-58.7154	-28.8741	-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	321.5272	268.8854	244.6706	186.9465	152.5515	109.3154	107.0319	128.4913	158.5305	244.8677	287.9624	318.3556 (64)
								Total per year (kWh/year) = Sum(64)m =				2529.1360 (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	119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420 (68)
Pumps, fans	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Total internal gains	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010 (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

Northeast					2.0000	11.2829	0.7600	0.7000				0.7700	8.3195 (75)
Southeast					11.3400	36.7938	0.7600	0.7000				0.7700	153.8271 (77)
Southwest					6.1600	36.7938	0.7600	0.7000				0.7700	83.5604 (79)
Northwest					3.3600	11.2829	0.7600	0.7000				0.7700	13.9768 (81)

Solar gains	259.6838	449.7435	635.0301	819.8055	948.3461	954.7262	914.9488	817.0279	698.7016	502.3663	312.3900	221.3625	(83)
Total gains	921.9765	1109.6866	1275.2363	1423.2223	1515.1237	1454.4338	1395.1265	1300.5254	1201.0963	1072.3126	922.8135	867.0636	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	18.1638	18.1973	18.2303	18.3868	18.4164	18.5554	18.5554	18.5813	18.5016	18.4164	18.3566	18.2946
util living area	2.2109	2.2132	2.2154	2.2258	2.2278	2.2370	2.2370	2.2388	2.2334	2.2278	2.2238	2.2196
	0.9538	0.9307	0.8947	0.8330	0.7401	0.6232	0.5007	0.5423	0.7176	0.8631	0.9350	0.9592 (86)
Living	18.3572	18.6509	19.1019	19.6624	20.1706	20.5418	20.7245	20.6922	20.3876	19.7325	18.9397	18.3020
Non living	16.3389	16.7063	17.2669	17.9540	18.5425	18.9386	19.0883	19.0720	18.8015	18.0615	17.0839	16.2750
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	19.6481	18.6509	19.1019	19.6624	20.1706	20.5418	20.7245	20.6922	20.3876	19.7325	18.9397	18.6794 (87)
Th 2	19.2835	19.2860	19.2884	19.3000	19.3022	19.3123	19.3123	19.3142	19.3084	19.3022	19.2978	19.2932 (88)
util rest of house	0.9436	0.9157	0.8710	0.7930	0.6722	0.5105	0.3399	0.3831	0.6186	0.8211	0.9181	0.9502 (89)
MIT 2	18.1079	16.7063	17.2669	17.9540	18.5425	18.9386	19.0883	19.0720	18.8015	18.0615	17.0839	16.8183 (90)
Living area fraction												
MIT	18.7982	17.5779	18.0893	18.7197	19.2722	19.6571	19.8217	19.7982	19.5124	18.8104	17.9156	17.6524 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7982	17.5779	18.0893	18.7197	19.2722	19.6571	19.8217	19.7982	19.5124	18.8104	17.9156	17.6524 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9401	0.8956	0.8498	0.7764	0.6708	0.5364	0.3932	0.4339	0.6326	0.8057	0.8994	0.9384 (94)
Ext temp.	866.7572	993.8472	1083.6356	1105.0310	1016.3355	780.1305	548.4956	564.3323	759.7763	863.9625	829.9901	813.6847 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2782.2068	2428.4108	2215.8858	1861.5407	1433.1837	949.9872	605.1926	637.4539	1019.6750	1553.9682	2053.7206	2563.0733 (97)
Space heating requirement - total per year (kWh/year)	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451 (98a)
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6782.3327
Space heating per m2												73.3542 (99)

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

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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 %)													357.6958 (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	1425.0945	964.0267	842.3941	544.6870	310.1351	0.0000	0.0000	0.0000	0.0000	513.3642	881.0859	1301.5451	(98)
Space heating efficiency (main heating system 1)	357.6958	357.6958	357.6958	357.6958	357.6958	0.0000	0.0000	0.0000	0.0000	357.6958	357.6958	357.6958	(210)
Space heating fuel (main heating system)	398.4096	269.5102	235.5057	152.2766	86.7036	0.0000	0.0000	0.0000	0.0000	143.5198	246.3227	363.8693	(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	321.5272	268.8854	244.6706	186.9465	152.5515	109.3154	107.0319	128.4913	158.5305	244.8677	287.9624	318.3556	(64)
Efficiency of water heater	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	182.6384	(216)
Fuel for water heating, kWh/month	176.0458	147.2228	133.9645	102.3588	83.5265	59.8535	58.6032	70.3528	86.8002	134.0724	157.6681	174.3092	(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	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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.5357	-63.3015	-97.8966	-114.7514	-122.6920	-102.5935	-101.0602	-95.4427	-83.8928	-73.5560	-46.6773	-35.0296	(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	-11.3620	-27.3812	-61.9086	-105.4997	-153.4325	-170.2167	-167.6034	-136.8503	-93.9726	-43.9292	-16.5675	-8.8855	(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													1896.1174 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													182.6384
Water heating fuel used													1384.7777 (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)													219.4653 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation													-1976.0385 (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													1604.3219 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1896.1174	16.4900	312.6698 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1384.7777	16.4900	228.3498 (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	219.4653	16.4900	36.1898 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.4294	16.4900	-161.3430
PV Unit electricity exported	-997.6091	5.5900	-55.7664
Total			-217.1094 (252)
Total energy cost			373.2921 (255)

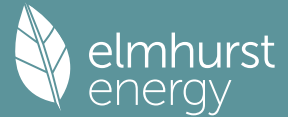
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9776 (257)
SAP value		84.1526
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1896.1174	0.1547	293.3393 (261)

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Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1384.7777	0.1452	201.0211 (264)
Space and water heating			494.3604 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.4294	0.1346	-131.6967
PV Unit electricity exported	-997.6091	0.1216	-121.3367
Total			-253.0334 (269)
Total CO2, kg/year			284.0996 (272)
CO2 emissions per m2			3.0700 (273)
EI value			97.2305
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	92.4600 (1b)	x 2.6400 (2b)	= 244.0944 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 244.0944 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1229 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3729 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3729 (21)

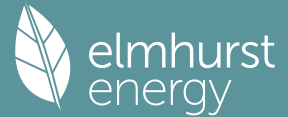
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4475	0.4195	0.4102	0.3636	0.3636	0.3356	0.3449	0.3263	0.3449	0.3729	0.3822	0.4102 (22b)
Effective ac	0.6001	0.5880	0.5841	0.5661	0.5661	0.5563	0.5595	0.5532	0.5595	0.5695	0.5730	0.5841 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			22.8600	1.3258	30.3068		(27)
Opening Type 2			1.8900	1.4000	2.6460		(26)
Heatloss Floor 1			92.4600	0.1500	13.8690	110.0000	10170.6000 (28a)
External Wall 1	111.4800	24.7500	86.7300	0.2600	22.5498	9.0000	780.5700 (29a)
External Roof 1	92.4600		92.4600	0.1500	13.8690	9.0000	832.1400 (30)
Total net area of external elements Aum(A, m2)			296.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.2406		(33)
Main dwelling							
Internal Wall 1			85.0000			9.0000	765.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12548.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.7161 (35)
Thermal bridges (Default value 0.200 * total exposed area)							59.2800 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	142.5206 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.3404	47.3638	47.0523	45.5996	45.5996	44.8121	45.0676	44.5635	45.0676	45.8762	46.1597	47.0523 (38)
Average = Sum(39)m / 12 =	190.8611	189.8844	189.5729	188.1203	188.1203	187.3327	187.5882	187.0841	187.5882	188.3968	188.6803	189.5729 (39)
												188.5668
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.0643	2.0537	2.0503	2.0346	2.0346	2.0261	2.0289	2.0234	2.0289	2.0376	2.0407	2.0503 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6579 (42)
Hot water usage for mixer showers												68.5207 (42a)
Hot water usage for baths												31.1603 (42b)
Hot water usage for other uses												44.0523 (42c)
Average daily hot water use (litres/day)												132.4529 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	144.1027	141.0027	137.2406	131.5510	126.9195	121.9447	120.0558	123.8019	127.7495	132.9692	138.7455	143.7334 (44)
Energy content (annual)	228.2234	200.7860	210.9337	180.0868	170.8580	149.9452	145.1971	153.2926	157.5279	180.4379	197.6684	225.0518 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2200.0088
Water storage loss (or HIU loss):												150.0000 (47)
Store volume												1.5900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.2402 (55)
Enter (49) or (54) in (55)												
Total storage loss												38.4462 (56)
If cylinder contains dedicated solar storage												38.4462 (57)
Primary loss												54.8576 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												321.5272 (62)
WWHRS												0.0000 (63a)
PV diverter												-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												758.1212 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												758.1212
Solar input	-0.1956	-19.9561	-65.5808	-96.7642	-121.7637	-117.4000	-115.4986	-102.9833	-71.6268	-40.0558	-6.2963	-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	321.3316	265.1042	238.6567	173.6166	142.3981	92.2632	91.4071	112.0179	145.6191	233.6859	281.6662	318.3556 (64)
Electric shower(s)												Total per year (kWh/year) = Sum(64)m = 2416.1222 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	119.7704	106.4004	114.0215	102.3493	100.6964	67.8664	66.8879	69.5797	70.3876	103.8817	108.1952	118.7158 (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	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750	159.4750 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.0676	27.5940	22.4409	16.9892	12.6996	10.7216	11.5850	15.0587	20.2117	25.6634	29.9530	31.9311 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.4797	367.2515	357.7467	337.5122	311.9697	287.9634	271.9257	268.1539	277.6587	297.8932	323.4357	347.4420 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054	53.6054 (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)	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167	-106.3167 (71)
Water heating gains (Table 5)	160.9817	158.3339	153.2548	142.1517	135.3446	94.2589	89.9032	93.5211	97.7606	139.6259	150.2710	159.5642 (72)
Total internal gains	662.2927	659.9431	640.2061	603.4169	566.7777	499.7076	480.1777	483.4975	502.3948	569.9463	610.4235	645.7010 (73)

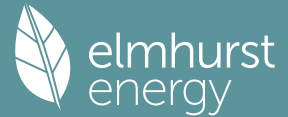
6. Solar gains

[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	
Northeast					2.0000	13.7622		0.7600	0.7000		0.7700	10.1476 (75)	
Southeast					11.3400	42.6275		0.7600	0.7000		0.7700	178.2166 (77)	
Southwest					6.1600	42.6275		0.7600	0.7000		0.7700	96.8090 (79)	
Northwest					3.3600	13.7622		0.7600	0.7000		0.7700	17.0479 (81)	
Solar gains	302.2212	465.9367	657.9217	900.6632	1006.9278	1085.8065	1027.5834	922.6208	776.7553	557.1617	367.1952	249.1126	(83)
Total gains	964.5139	1125.8798	1298.1278	1504.0801	1573.7055	1585.5141	1507.7611	1406.1183	1279.1501	1127.1080	977.6186	894.8137	(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	18.2627	18.3566	18.3868	18.5288	18.5288	18.6067	18.5813	18.6314	18.5813	18.5016	18.4738	18.3868
alpha	2.2175	2.2238	2.2258	2.2353	2.2353	2.2404	2.2388	2.2421	2.2388	2.2334	2.2316	2.2258
util living area	0.9455	0.9245	0.8832	0.8044	0.6923	0.5414	0.4037	0.4167	0.6460	0.8247	0.9175	0.9514 (86)
Living	18.5495	18.7830	19.2503	19.8270	20.3301	20.6562	20.7912	20.7890	20.5381	19.9698	19.1946	18.5403
Non living	16.5854	16.8787	17.4566	18.1524	18.7185	19.0349	19.1241	19.1284	18.9470	18.3439	17.4064	16.5807
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	19.7464	18.7830	19.2503	19.8270	20.3301	20.6562	20.7912	20.7890	20.5381	19.9698	19.1946	18.8844 (87)
Th 2	19.2908	19.2978	19.3000	19.3104	19.3104	19.3160	19.3142	19.3178	19.3142	19.3084	19.3064	18.3000 (88)
util rest of house	0.9332	0.9078	0.8564	0.7581	0.6120	0.4145	0.2308	0.2342	0.5248	0.7688	0.8952	0.9400 (89)
MIT 2	18.2109	16.8787	17.4566	18.1524	18.7185	19.0349	19.1241	19.1284	18.9470	18.3439	17.4064	17.0703 (90)
Living area fraction									fLA = Living area /	(4) =		0.4482 (91)
MIT	18.8991	17.7322	18.2605	18.9030	19.4408	19.7615	19.8713	19.8727	19.6601	19.0726	18.2079	17.8834 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8991	17.7322	18.2605	18.9030	19.4408	19.7615	19.8713	19.8727	19.6601	19.0726	18.2079	17.8834 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9298	0.8875	0.8357	0.7448	0.6191	0.4513	0.2919	0.2990	0.5532	0.7592	0.8760	0.9274 (94)
Useful gains	896.7862	999.2253	1084.8912	1120.2355	974.2379	715.5426	440.1698	420.4297	707.6021	855.7498	856.3772	829.8917 (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	2652.7958	2341.6939	2115.7356	1768.8866	1286.8946	817.0552	463.5854	443.8860	874.1821	1388.9814	1907.1552	2404.4199 (97)
Space heating kWh	1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98a)
Space heating requirement - total per year (kWh/year)												5999.9371
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	1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5999.9371
Space heating per m2										(98c) / (4) =		64.8922 (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 %)												357.3593 (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	1306.4711	902.1388	766.9483	467.0288	232.6166	0.0000	0.0000	0.0000	0.0000	396.7243	756.5602	1171.4490 (98)
Space heating efficiency (main heating system 1)	357.3593	357.3593	357.3593	357.3593	357.3593	0.0000	0.0000	0.0000	0.0000	357.3593	357.3593	357.3593 (210)
Space heating fuel (main heating system)	365.5904	252.4459	214.6155	130.6889	65.0932	0.0000	0.0000	0.0000	0.0000	111.0155	211.7085	327.8071 (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	321.3316	265.1042	238.6567	173.6166	142.3981	92.2632	91.4071	112.0179	145.6191	233.6859	281.6662	318.3556 (64)
Efficiency of water heater (217)m	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233	182.6233 (216)
Fuel for water heating, kWh/month	175.9532	145.1645	130.6825	95.0681	77.9737	50.5210	50.0523	61.3382	79.7374	127.9606	154.2334	174.3236 (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	27.1933	21.8155	19.6424	14.3909	11.1159	9.0818	10.1403	13.1808	17.1205	22.4630	25.3719	27.9491 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-48.3140	-66.2701	-101.3198	-120.8849	-124.1270	-107.6171	-105.5882	-100.9671	-89.7253	-79.5765	-54.1634	-39.6053 (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	-14.9851	-30.2881	-68.1506	-124.8085	-171.5450	-204.4158	-198.2235	-164.5736	-112.0789	-54.2060	-22.2798	-11.1978 (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												1678.9649 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												182.6233
Water heating fuel used												1323.0085 (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)												219.4653 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2214.9114 (233)
Wind generation												0.0000 (234)

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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	1086.5273 (238)

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1678.9649	27.6700	464.5696 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1323.0085	27.6700	366.0765 (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	219.4653	27.6700	60.7261 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1038.1587	27.6700	-287.2585
PV Unit electricity exported	-1176.7527	5.8100	-68.3693
Total			-355.6278 (252)
Total energy cost			557.8803 (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	1678.9649	0.1552	260.5982 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1323.0085	0.1460	193.1112 (264)
Space and water heating			453.7094 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	219.4653	0.1443	31.6756 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1038.1587	0.1349	-139.9975
PV Unit electricity exported	-1176.7527	0.1214	-142.8335
Total			-282.8310 (269)
Total CO2, kg/year			213.6510 (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	1678.9649	1.5746	2643.6985 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1323.0085	1.5400	2037.3836 (278)
Space and water heating			4681.0821 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	219.4653	1.5338	336.6233 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1038.1587	1.4984	-1555.5981
PV Unit electricity exported	-1176.7527	0.4452	-523.8954
Total			-2079.4935 (283)
Total Primary energy kWh/year			3059.2358 (286)