

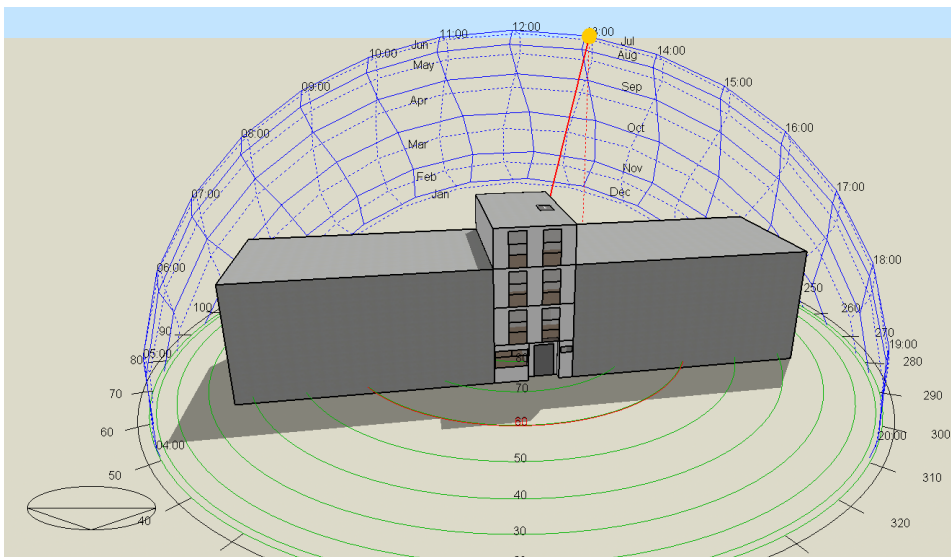
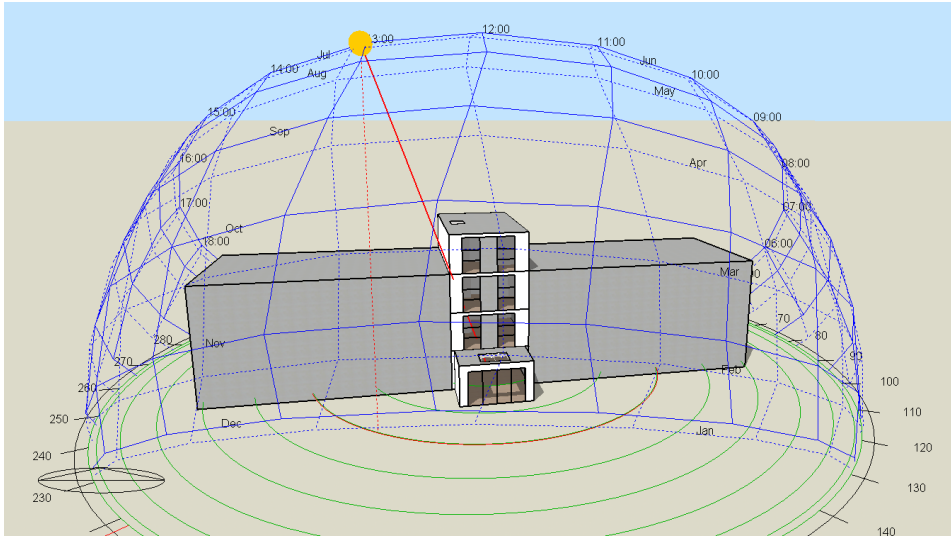
**Overheating Risk & Energy Assessment
Revision 2**

For

**9 Briary Close
London
NW3 3JZ**

Date: 28 October 2024

EXISTING DWELLING 9 BRIARY CLOSE, NW3 3JZ



Modelled in DesignBuilder 7.2.0.032 Utilizing Energyplus Version 9.4.0.002 in accordance with CIBSE AM11 using guidance outlined in CIBSE TM59.

CONTENTS

EXECUTIVE SUMMARY	4
Basis of Methodology for this Assessment.....	5
Results Overview.....	5
CALCULATION PARAMETERS.....	6
U-Values	6
Thermal Mass.....	6
Ventilation Strategy	6
Internal Gains	8
Weather File	8
OVERHEATING	9
Results	9
Indoor Temperature Distribution	10
COOLING HIERARCHY.....	11
ENERGY REDUCTION.....	12
Energy Use.....	12
CO2 Emissions.....	12
CONCLUSION	13
SAP 10 CALCULATION PRINTOUTS.....	14

EXECUTIVE SUMMARY

This report seeks to demonstrate whether the existing dwelling at 9 Briary Close, London meets the requirements of TM59: Design methodology for the assessment of overheating risk in homes. If the requirements of TM59 are shown not to be met, installing Air Conditioning is an option which may be sought providing the requirements of the Cooling Hierarchy within the Camden Local Plan are investigated and other methods of achieving acceptable comfort levels cannot be introduced as an alternative. As Air Conditioning has already been installed and extended as part of a recent extensive refurbishment and extension works this report is in support of a retrospective planning application for its justification for installation.

Furthermore, the report will also demonstrate that as a result of the refurbishment and extensions, energy use has been vastly reduced and therefore carbon emissions have also been reduced.

Compliance Criteria for Overheating

Homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (mvhr), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method based on CIBSE TM52 (2013).

In order to allow the occupants to 'adapt', each habitable room needs operable windows with a minimum free area that satisfies the purge ventilation criteria set in Part F of the Building Regulations for England (NBS, 2010), i.e. the window opening area should be at least 1/20th of the floor area of the room (different conditions exist for windows with restricted openings, and the same requirement applies for external doors). Control of overheating may require accessible, secure, quiet ventilation with a significant openable area.

Homes that are predominantly mechanically ventilated because they have either no opportunity or extremely limited opportunities for opening windows (e.g. due to noise levels or air quality) should be assessed for overheating using the fixed temperature method based on CIBSE Guide A (2015a).

Criteria for homes predominantly naturally ventilated

Compliance is based on passing *both* of the following two criteria:

(a) *For living rooms, kitchens and bedrooms*: the number of hours during which DT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: *Hours of exceedance*).

(b) *For bedrooms only*: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (*Note*: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

Criteria for homes predominantly mechanically ventilated

For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).

Basis of Methodology for this Assessment

There is reasonable opportunity for natural ventilation in the summer within the property and therefore the adaptive method for homes predominately naturally ventilated is to be used.

Assessments are based upon occupied hours between May and September, this equates to 3,672 hours per year for bedrooms and 1,989 hours per year for Living rooms.

Inclusion of Window Blinds & Ceiling Fans

At the request of the Local Authority internal window blinds have been added to the dynamic thermal model to establish their effect on the results.

Ceiling fans cannot be added to the assessment and are not considered within TM59, these will only have the effect of moving warm air around the room in any case. The MVHR unit which is installed provides adequate air movement and exchange in order to give some cooling effect.

MVHR with Air Tempering

The installed MVHR system installed provides external air tempering by its very nature, it will exchange warm internal air and exchange it for cooler external air.

If the incoming air was to be mechanically tempered, this would require an outside air conditioning unit to run through an internal coil within the MVHR unit, this would constitute by very nature an air conditioning system.

Results Overview

The results obtained from the thermal model demonstrate that all rooms of the property do not pass the requirements of TM59, it can be seen that this is exacerbated at second and third floor levels, indicating significant overheating will occur.

CALCULATION PARAMETERS

U-Values

External Walls, clear cavity with 50mm PIR to internal face	0.29 W/m ² K
Flat Roofs, well insulated to current regulations	0.18 W/m ² K
Ground Floor	0.30 W/m ² K
Windows, Rooflights & Glazed Doors	1.40 W/m ² K

Glazing

Windows and glazed doors with an anticipated g-value of 0.50 and light transmission of 0.80 has been allowed for.

Room and Glazing Sizes

Taken from plan drawings and elevations, produced by ZED Architect.

Thermal Mass

Medium-weight construction to ground, first and second floor elements.
Timber joist upper floor flooring and timber stud partitioning
Light-weight construction to third floor elements largely built within timber structures.

Ventilation Strategy

Openable windows available to all occupied areas however middle windows are restricted to 100mm for safety reasons, high level windows have been modelled as fully open. Free Areas calculated accordingly.

Ground floor windows modelled as closed from 11pm. Upper Floor Windows open at all times day and night.

In accordance with TM59 windows to be open when the internal dry bulb temperature exceeds 22°C and the room is occupied.

As part of the refurbishment, MVHR has been added throughout the property to improve internal air quality and reduce the cooling load of the air conditioning. This has been included within the calculations for overheating. The unit exchanges air at the rate of 75 l/s.

Lighting

In accordance with TM59, lighting gains are set at 2 W/m^2 and on between 6pm and 11pm.

Air Permeability

Air permeability set at $15.0 \text{ m}^3/(\text{h.m}^2)$ at 50 Pa.

Internal Gains

In accordance with TM59

Room Ref:	Occupancy Gains	Lighting Gains W/m ²	Equipment Gains W/m ²
Bedrooms	2*	2.0	80W Peak Load*
Kitchen	4*	2.0	450W Peak Load*
Living	4*	2.0	150W Peak Load*

*Adjusted in accordance with TM59 for differing time periods of the day.

Occupied Times

In accordance with TM59

Room Ref	Occupancy
Single Bedrooms	1 person at 70% gains from 11pm to 8am 1 person at full gains from 8am to 11pm
Double Bedrooms	2 people at 70% gains from 11pm to 8am 2 people at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gain in the bedroom from 9am to 10pm
Living	4 people at 5% gains from 9 am to 10 pm; room is unoccupied for the rest of the day
Kitchen	4 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day

Weather File

London Central DSY1 2020s, high emissions, 50% percentile scenario in accordance with TM59

OVERHEATING

Compliance is based on passing *both* of the following two criteria:

(a) *For living rooms, kitchens and bedrooms*: the number of hours during which DT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: *Hours of exceedance*).

(b) *For bedrooms only*: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

Results of the above calculations can be viewed below and can be seen that all occupied space fails the required benchmark of CIBSE TM59.

Results without Window Blinds

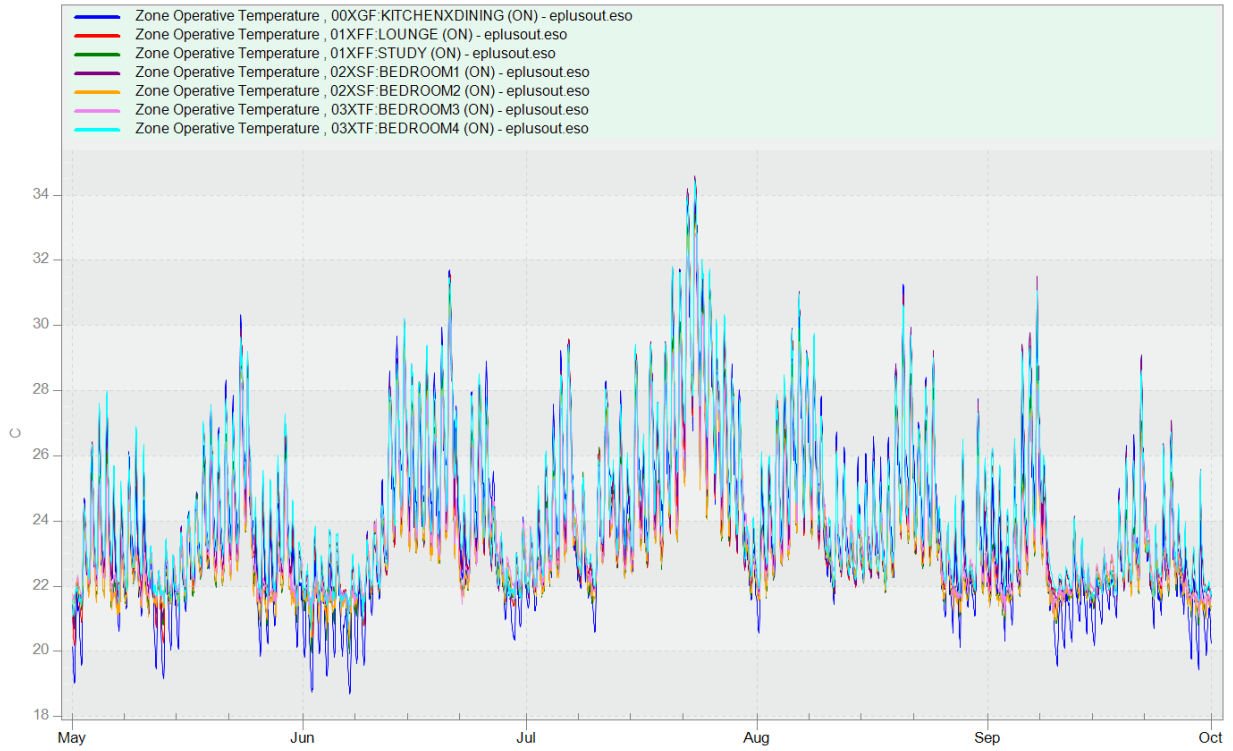
Dwelling	Level	Zone	Criterion A (%)	Criterion B (hr)	Pass / Fail
9 Briary Close	Grd Flr	Kitchen Diner	3.86	N/A	Fail
	First Flr	Lounge	4.05	N/A	Fail
	First Flr	Study / Bedroom	1.43	75.67	Fail
	Second Flr	Bedroom 1	3.24	104.00	Fail
	Second Flr	Bedroom 2	0.92	71.17	Fail
	Third Flr	Bedroom 3	0.77	80.67	Fail
	Third Flr	Bedroom 4	3.37	112.83	Fail

Results with Window Blinds

Dwelling	Level	Zone	Criterion A (%)	Criterion B (hr)	Pass / Fail
9 Briary Close	Grd Flr	Kitchen Diner	3.14	N/A	Fail
	First Flr	Lounge	3.62	N/A	Fail
	First Flr	Study / Bedroom	0.74	62.50	Fail
	Second Flr	Bedroom 1	1.15	85.33	Fail
	Second Flr	Bedroom 2	0.69	60.83	Fail
	Third Flr	Bedroom 3	0.64	67.00	Fail
	Third Flr	Bedroom 4	1.06	89.33	Fail

Indoor Temperature Distribution

01 May – 30 September



COOLING HIERARCHY

In accordance with Camden Local Plan air conditioning will only be permitted where dynamic thermal modelling demonstrates there is a clear need for it after all of the preferred measures are incorporated in line with the cooling hierarchy.

The cooling hierarchy includes:

- Minimise internal heat generation through energy efficient design;
- Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
- Manage the heat within the building through exposed internal mass and high ceilings;
- Passive ventilation;
- Mechanical ventilation;
- Active cooling.

As the property has been completely refurbished, thermal quality has been improved to current regulations. Orientation and window sizes could not have been changed as the refurbishment needed to be in keeping with the surrounding buildings. Windows with a reasonably low g-value have been installed in an attempt to reduce solar gains.

Windows were designed to allow adequate passive ventilation with openable windows at all levels, however these need to be restricted in the middle panes for safety reasons but allowing top level windows out of reach from children to be fully opened.

Passive shading could not be introduced without changing the look of the existing building or at great expense. Internal blinds have been added to the thermal model, which is representative of how the occupant uses the building.

A Mechanical Ventilation Heat Recovery (MVHR) system has been added throughout to reduce the cooling load. The chosen system comes with summertime bypass to allow cool outside air to bypass the heat recovery unit to prevent incoming air being pre-heated by internal warm air.

ENERGY REDUCTION

This section will provide an overview of the energy reduction and CO2 emission reduction achieved by the extensive refurbishment undertaken, improved thermal quality of the structure, efficient LED lighting and including the introduction of a highly efficient Air Source Heat Pump in lieu of a non-condensing gas fired boiler to heat the property along with domestic hot water.

Comfort cooling was included prior to the refurbishment, however this has been extended into newly formed areas.

Results have been created using SAP 10

Energy Use

	Pre-Refurbishment KWh/year	Post Refurbishment KWh/year
Space heating	20,801.52	6,729.25
Water heating	5,404.15	1,800.15
Space cooling	34.91	8.03
Fans & Pumps	86.00	719.07
Lighting	461.59	391.73
PV electricity used	-1,282.49	-3,383.68
	25,505.57	6,264.55

The above results represent a 75% reduction in energy use as a result of the refurbishment works undertaken.

It can also be seen that the energy used from comfort cooling is less than 1%, this has been almost halved following refurbishment, however the introduction of MVHR has increased power used by fans as could be expected.

3.94KWp of PV was installed pre-refurbishment and has been re-installed on the new roof on completion. A new 20KW battery has been added which allows for greater use of the installed PV, allowing energy to be collected and used when required.

CO2 Emissions

	Pre-Refurbishment	Post Refurbishment
Total Kg CO2/year	5,412.81	1003.59

The above results represent an 81% reduction in CO2 emissions as a result of the refurbishment works undertaken.

CONCLUSION

It can be viewed from the results within this report that overheating is expected within the building even following extensive refurbishment. When considering the cooling hierarchy of the Camden Local Plan much of the recommendations to mitigate the need for mechanical cooling have been introduced, however overheating is still expected and therefore it is believed that retrospective planning permission for comfort cooling should not be withheld.

The report demonstrates that the inclusion of comfort cooling does not adversely affect energy use or therefore CO2 emissions. The extensive refurbishment and extensions have vastly reduced the energy consumption as a whole and further adding weight for the inclusion of comfort cooling being permitted.

SAP 10 CALCULATION PRINTOUTS

Full SAP Calculation Printout



Property Reference	9 Briary Close			Issued on Date	19/07/2024
Assessment Reference	Post Refurbishment	Prop Type Ref	9 Briary Close		
Property					
SAP Rating	78 C	DER	4.43	TER	
Environmental	95 A	% DER < TER			N/A
CO ₂ Emissions (t/year)	0.81	DFEE	102.52	TFEE	
Compliance Check	See BREL	% DFEE < TFEE			
% DPER < TPER		DPER	44.11	TPER	
Assessor Details	Mr. Jason Cook			Assessor ID	V572-0001
Client	MZA Planning, Charlotte Hirst				

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.5600 (1b)	x 2.8500 (2b)	= 192.5460 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Third floor	53.9800 (1e)	x 2.7500 (2e)	= 148.4450 (1e) - (3e)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	229.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	637.8810 (5)

2. Ventilation rate

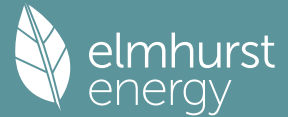
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Number of storeys in the dwelling (ns)	4 (9)
Additional infiltration	[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0.0000 (12)
If no draught lobby, enter 0.05, else enter 0	0.0500 (13)
Percentage of windows and doors draught stripped	100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.7500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6375 (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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.8943	0.8784	0.8624	0.7828	0.7668	0.6871	0.6871	0.6712	0.7190	0.7668	0.7987	0.8306 (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
New Windows (Uw = 1.40)			40.7200	1.3258	53.9848		(27)
Solid Door (New)			2.7600	1.4000	3.8640		(26)
Heatloss Floor 1			53.3000	0.3000	15.9900	110.0000	5863.0000 (28a)

Full SAP Calculation Printout



External Wall 1	177.1600	43.4800	133.6800	0.2900	38.7672	190.0000	25399.2000	(29a)
External Wall 2	115.1400		115.1400	0.2600	29.9364	190.0000	21876.6000	(29a)
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200	(30)
Total net area of external elements Aum(A, m2)			399.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	228.9104				(33)
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000	(32)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			65045.8200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							283.4241	(35)
Thermal bridges (Default value 0.200 * total exposed area)							79.9160	(36)
Point Thermal Bridges							(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =			308.8264	(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	188.2534	184.8986	181.5437	164.7694	161.4146	144.6403	144.6403	141.2855	151.3500	161.4146	168.1243	174.8340	(38)
Heat transfer coeff	497.0799	493.7250	490.3702	473.5959	470.2410	453.4668	453.4668	450.1119	460.1765	470.2410	476.9508	483.6605	(39)
Average = Sum(39)m / 12 =												472.7572	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	2.1659	2.1513	2.1367	2.0636	2.0490	1.9759	1.9759	1.9613	2.0051	2.0490	2.0782	2.1075	(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													3.0403	(42)
Hot water usage for mixer showers	65.7960	64.8072	63.3663	60.6095	58.5750	56.3062	55.0166	56.4466	58.0141	60.4501	63.2661	65.5439	(42a)	
Hot water usage for baths	34.1681	33.6607	32.9461	31.6285	30.6419	29.5479	28.9570	29.6666	30.4392	31.6098	32.9545	34.0526	(42b)	
Hot water usage for other uses	48.1742	46.4224	44.6706	42.9188	41.1671	39.4153	39.4153	41.1671	42.9188	44.6706	46.4224	48.1742	(42c)	
Average daily hot water use (litres/day)												136.1356	(43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	148.1383	144.8902	140.9830	135.1568	130.3840	125.2694	123.3889	127.2803	131.3722	136.7305	142.6431	147.7707	(44)	
Distribution loss (46)m = 0.15 x (45)m	234.6148	206.3218	216.6856	185.0230	175.5219	154.0334	149.2282	157.5996	161.9950	185.5421	203.2212	231.3731	(45)	
Store volume										Total = Sum(45)m =		2261.1597		
a) If manufacturer declared loss factor is known (kWh/day):	35.1922	30.9483	32.5028	27.7534	26.3283	23.1050	22.3842	23.6399	24.2993	27.8313	30.4832	34.7060	(46)	
Temperature factor from Table 2b													300.0000	(47)
Enter (49) or (54) in (55)													1.6000	(48)
Total storage loss													0.5400	(49)
If cylinder contains dedicated solar storage													0.8640	(55)
Primary loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)	
Combi loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)	
Total heat required for water heating calculated for each month	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	37.2980	36.0948	37.2980	36.0948	37.2980	(59)	
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	(61)	
PV diverter	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
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	(63b)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
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	(63d)	
Total per year (kWh/year) = Sum(64)m =	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(64)	
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)	
Heat gains from water heating, kWh/month	129.2750	114.9064	123.3135	111.1320	109.6266	100.8279	100.8840	103.6674	103.4752	112.9583	117.1829	128.1971	(65)	

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

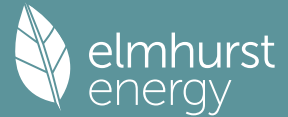
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.4531	49.2530	40.0552	30.3244	22.6678	19.1371	20.6783	26.8785	36.0763	45.8071	53.4637	56.9943	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	594.4551	600.6237	585.0791	551.9864	510.2128	470.9516	444.7226	438.5540	454.0987	487.1914	528.9649	568.2262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	(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)	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	(71)
Water heating gains (Table 5)	173.7567	170.9916	165.7440	154.3500	147.3476	140.0388	135.5967	139.3379	143.7155	151.8257	162.7540	172.3080	(72)
Total internal gains	940.7525	937.9559	907.9659	853.7483	797.3158	747.2151	718.0852	721.8580	750.9780	801.9117	862.2702	914.6161	(73)

6. Solar gains

[Jan]													Area		Solar flux		g		FF		Access		Gains	
													m2		Table 6a		Specific data		Specific data		factor		W	
													W/m2		or Table 6b		or Table 6c		Table 6d					
North													21.7300	10.6334	0.5000	0.7000	0.7700	56.0445	(74)					
South													18.9900	46.7521	0.5000	0.7000	0.7700	215.3412	(78)					

Solar gains	271.3856	459.7772	631.2389	800.0741	922.8965	930.7577	891.0968	795.4112	688.1054	507.8844	324.3908	232.7960	(83)											
Total gains	1212.1382	1397.7331	1539.2048	1653.8224	1720.2123	1677.9728	1609.1820	1517.2693	1439.0834	1309.7961	1186.6609	1147.4121	(84)											

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3489	36.5958	36.8462	38.1513	38.4235	39.8448	39.8448	40.1418	39.2638	38.4235	37.8829	37.3574	21.0000 (85)
alpha	3.4233	3.4397	3.4564	3.5434	3.5616	3.6563	3.6563	3.6761	3.6176	3.5616	3.5255	3.4905	
util living area	0.9988	0.9979	0.9960	0.9913	0.9778	0.9383	0.8607	0.8888	0.9679	0.9933	0.9981	0.9991	(86)
Living	18.4341	18.6233	18.9733	19.4978	20.0098	20.5063	20.7731	20.7310	20.3401	19.6792	19.0048	18.4534	
Non living	16.9782	17.1733	17.5289	18.0830	18.5935	19.0920	19.2904	19.2769	18.9349	18.2716	17.5863	17.0225	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	24	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	7	28	31	0	0	0	0	0	0	0	4	31	
MIT	20.6718	19.6539	19.8522	19.4978	20.0098	20.5063	20.7731	20.7310	20.3401	19.6792	19.1202	19.5577	(87)
Th 2	19.2250	19.2344	19.2438	19.2913	19.3009	19.3495	19.3495	19.3593	19.3299	19.3009	19.2817	19.2627	(88)
util rest of house	0.9983	0.9970	0.9940	0.9860	0.9602	0.8710	0.6761	0.7323	0.9310	0.9882	0.9971	0.9987	(89)
MIT 2	18.9377	18.0670	18.2725	18.0830	18.5935	19.0920	19.2904	19.2769	18.9349	18.2716	17.6844	17.9939	(90)
Living area fraction									fLA = Living area / (4) =			0.3697	(91)
MIT	19.5787	18.6537	18.8565	18.6060	19.1171	19.6148	19.8385	19.8145	19.4543	18.7920	18.2151	18.5720	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5787	18.6537	18.8565	18.6060	19.1171	19.6148	19.8385	19.8145	19.4543	18.7920	18.2151	18.5720	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9965	0.9934	0.9827	0.9574	0.8861	0.7480	0.7912	0.9351	0.9857	0.9960	0.9984	(94)
Useful gains	1210.2329	1392.8977	1529.1122	1625.2547	1646.9722	1486.8126	1203.6285	1200.4150	1345.7339	1291.1193	1181.9515	1145.6307	(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	7594.7550	6790.5225	6059.2492	4596.7325	3487.8103	2274.0614	1468.5446	1536.8877	2463.9380	3852.2095	5301.3698	6951.1551	(97)
Space heating kWh	4750.0845	3627.2038	3370.4219	2139.4640	1369.5835	0.0000	0.0000	0.0000	0.0000	1905.4511	2965.9811	4319.3102	(98a)
Space heating requirement - total per year (kWh/year)												24447.5002	
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	4750.0845	3627.2038	3370.4219	2139.4640	1369.5835	0.0000	0.0000	0.0000	0.0000	1905.4511	2965.9811	4319.3102	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												24447.5002	
Space heating per m2										(98c) / (4) =		106.5251	(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	4262.5876	3355.6540	3420.8505	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.4190	0.4996	0.4650	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1786.1854	1676.5163	1590.7892	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1835.1137	1759.6269	1651.5595	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.2284	61.8343	45.2131	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			0.7451	(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	6.5622	11.5182	8.4220	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												26.5024	(107)

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

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

Fraction of space heat from main system(s)	0.0000	(201)
Efficiency of main space heating system 1 (in %)	1.0000	(202)
Efficiency of main space heating system 2 (in %)	363.3018	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(207)
Cooling System Energy Efficiency Ratio (see Table 10c)	0.0000	(208)
	3.3000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4750.0845	3627.2038	3370.4219	2139.4640	1369.5835	0.0000	0.0000	0.0000	0.0000	1905.4511	2965.9811	4319.3102	(98)
Space heating efficiency (main heating system 1)	363.3018	363.3018	363.3018	363.3018	363.3018	0.0000	0.0000	0.0000	0.0000	363.3018	363.3018	363.3018	(210)
Space heating fuel (main heating system)	1307.4762	998.3996	927.7196	588.8944	376.9823	0.0000	0.0000	0.0000	0.0000	524.4816	816.3959	1188.9042	(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	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(64)
Efficiency of water heater (217)m	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	(216)
Fuel for water heating, kWh/month	178.3021	157.7112	167.5996	147.4651	143.0276	128.9664	127.3320	132.3291	133.7190	149.0089	158.3283	176.3670	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	1.9885	3.4904	2.5521	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	61.0717	55.1616	61.0717	59.1017	61.0717	59.1017	61.0717	61.0717	59.1017	61.0717	59.1017	61.0717	(231)
Lighting	48.5378	38.9388	35.0601	25.6865	19.8410	16.2103	18.0996	23.5266	30.5587	40.0947	45.2869	49.8868	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-98.6636	-164.6106	-280.2298	-375.0871	-462.3423	-451.2123	-445.2837	-390.0854	-306.5196	-210.3236	-117.0173	-82.5656	(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	(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												6729.2539	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.5228	
Water heating fuel used												1800.1563	(219)
Space cooling fuel												8.0310	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)													
mechanical ventilation fans (SFP = 0.9240)												719.0705	(230a)
Total electricity for the above, kWh/year												719.0705	(231)
Electricity for lighting (calculated in Appendix L)												391.7278	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3383.9410	(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												6264.2986	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6729.2539	16.4900	1109.6540	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1800.1563	16.4900	296.8458	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Space cooling	8.0310	16.4900	1.3243	(248)
Pumps, fans and electric keep-hot	719.0705	16.4900	118.5747	(249)
Energy for lighting	391.7278	16.4900	64.5959	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3383.9410	16.4900	-558.0119	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-558.0119	(252)
Total energy cost			1032.9828	(255)

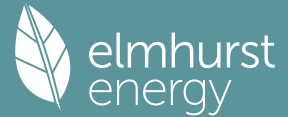
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3547	(257)
SAP value		78.0398	
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	6729.2539	0.1541	1037.1739	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1800.1563	0.1409	253.5719	(264)
Space and water heating			1290.7458	(265)
Space cooling	8.0310	0.1135	0.9119	(266)
Pumps, fans and electric keep-hot	719.0705	0.1387	99.7439	(267)
Energy for lighting	391.7278	0.1443	56.5384	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3383.9410	0.1313	-444.3504	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-444.3504	(269)
Total CO2, kg/year			1003.5897	(272)
CO2 emissions per m2			4.3700	(273)
EI value			95.1009	
EI rating			95	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.5600 (1b)	x 2.8500 (2b)	= 192.5460 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Third floor	53.9800 (1e)	x 2.7500 (2e)	= 148.4450 (1e) - (3e)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	229.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 637.8810 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Number of storeys in the dwelling (ns)	4 (9)
Additional infiltration	[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0.0000 (12)
If no draught lobby, enter 0.05, else enter 0	0.0500 (13)
Percentage of windows and doors draught stripped	100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.7500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6375 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.6694	0.6375	0.6375	0.5897	0.5897	0.5259	0.5419	0.5100	0.5259	0.5578	0.5578	0.6056 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.7509	0.7190	0.7190	0.6712	0.6712	0.6074	0.6234	0.5915	0.6074	0.6393	0.6393	0.6871 (25)

3. Heat losses and heat loss parameter

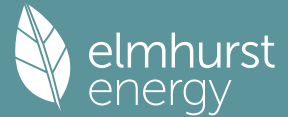
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
New Windows (Uw = 1.40)			40.7200	1.3258	53.9848		(27)
Solid Door (New)			2.7600	1.4000	3.8640		(26)
Heatloss Floor 1			53.3000	0.3000	15.9900	110.0000	5863.0000 (28a)
External Wall 1	177.1600	43.4800	133.6800	0.2900	38.7672	190.0000	25399.2000 (29a)
External Wall 2	115.1400		115.1400	0.2600	29.9364	190.0000	21876.6000 (29a)
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200 (30)
Total net area of external elements Aum(A, m ²)			399.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	228.9104			(33)
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000 (32)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		65045.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							283.4241 (35)
Thermal bridges (Default value 0.200 * total exposed area)							79.9160 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	308.8264 (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	158.0597	151.3500	151.3500	141.2855	141.2855	127.8660	131.2209	124.5112	127.8660	134.5757	134.5757	144.6403 (38)
Average = Sum(39)m / 12 =	466.8862	460.1765	460.1765	450.1119	450.1119	436.6925	440.0473	433.3376	436.6925	443.4022	443.4022	453.4668 (39)
												447.8753
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.0344	2.0051	2.0051	1.9613	1.9613	1.9028	1.9174	1.8882	1.9028	1.9320	1.9320	1.9759 (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												3.0403 (42)
Hot water usage for mixer showers												
Hot water usage for baths	65.7960	64.8072	63.3663	60.6095	58.5750	56.3062	55.0166	56.4466	58.0141	60.4501	63.2661	65.5439 (42a)
Hot water usage for other uses	34.1681	33.6607	32.9461	31.6285	30.6419	29.5479	28.9570	29.6666	30.4392	31.6098	32.9545	34.0526 (42b)
Average daily hot water use (litres/day)	48.1742	46.4224	44.6706	42.9188	41.1671	39.4153	39.4153	41.1671	42.9188	44.6706	46.4224	48.1742 (42c)
												136.1356 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.1383	144.8902	140.9830	135.1568	130.3840	125.2694	123.3889	127.2803	131.3722	136.7305	142.6431	147.7707	(44)
Energy conte	234.6148	206.3218	216.6856	185.0230	175.5219	154.0334	149.2282	157.5996	161.9950	185.5421	203.2212	231.3731	(45)
Energy content (annual)	Total = Sum(45)m = 2261.1597												
Distribution loss	35.1922	30.9483	32.5028	27.7534	26.3283	23.1050	22.3842	23.6399	24.2993	27.8313	30.4832	34.7060	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	37.2980	36.0948	37.2980	36.0948	37.2980	(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	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(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	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(64)
Total per year (kWh/year) = Sum(64)m = 3015.6731 (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	129.2750	114.9064	123.3135	111.1320	109.6266	100.8279	100.8840	103.6674	103.4752	112.9583	117.1829	128.1971	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	(66)
(66)m	55.4531	49.2530	40.0552	30.3244	22.6678	19.1371	20.6783	26.8785	36.0763	45.8071	53.4637	56.9943	(67)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	594.4551	600.6237	585.0791	551.9864	510.2128	470.9516	444.7226	438.5540	454.0987	487.1914	528.9649	568.2262	(68)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	(69)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see 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)
Pumps, fans	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	(71)
Losses e.g. evaporation (negative values) (Table 5)	173.7567	170.9916	165.7440	154.3500	147.3476	140.0388	135.5967	139.3379	143.7155	151.8257	162.7540	172.3080	(72)
Water heating gains (Table 5)	940.7525	937.9559	907.9659	853.7483	797.3158	747.2151	718.0852	721.8580	750.9780	801.9117	862.2702	914.6161	(73)
Total internal gains													

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North												21.7300	11.9814	0.5000	0.7000	0.7700	63.1495 (74)
South												18.9900	50.9848	0.5000	0.7000	0.7700	234.8373 (78)
Solar gains	297.9869	454.7181	619.3986	815.6684	922.8430	998.6586	944.7191	857.8302	734.0672	536.9413	364.9498	253.1444 (83)					
Total gains	1238.7394	1392.6740	1527.3645	1669.4167	1720.1588	1745.8737	1662.8043	1579.6882	1485.0452	1338.8530	1227.2200	1167.7604 (84)					

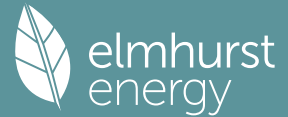
7. Mean internal temperature (heating season)

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)												
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.6995	39.2638	39.2638	40.1418	40.1418	41.3753	41.0599	41.6956	41.3753	40.7492	40.7492	39.8448
alpha	3.5800	3.6176	3.6176	3.6761	3.6761	3.7584	3.7373	3.7797	3.7584	3.7166	3.7166	3.6563
util living area	0.9986	0.9978	0.9954	0.9881	0.9643	0.8680	0.7049	0.7364	0.9396	0.9900	0.9975	0.9989 (86)
Living	18.7189	18.8904	19.2456	19.7529	20.2763	20.7489	20.9279	20.9159	20.5725	19.9362	19.3010	18.7527
Non living	17.3200	17.5044	17.8587	18.3825	18.8903	19.3145	19.3843	19.4021	19.1921	18.5801	17.9483	17.3802
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	18	0	0	0	0	0	0	0	0	0	0	0
16 / 9	13	28	24	0	0	0	0	0	0	0	0	31
MIT	20.4582	19.8052	19.8346	19.7529	20.2763	20.7489	20.9279	20.9159	20.5725	19.9362	19.3010	19.7272 (87)
Th 2	19.3105	19.3299	19.3299	19.3593	19.3593	19.3989	19.3890	19.4089	19.3989	19.3790	19.3790	19.3495 (88)
util rest of house	0.9980	0.9967	0.9929	0.9803	0.9324	0.7215	0.3866	0.4299	0.8641	0.9816	0.9960	0.9984 (89)
MIT 2	18.8377	18.2960	18.3526	18.3825	18.8903	19.3145	19.3843	19.4021	19.1921	18.5801	17.9483	18.2341 (90)
Living area fraction	19.4368	18.8539	18.9004	18.8891	19.4027	19.8448	19.9550	19.9617	fLA = Living area / (4) = 19.7024	19.0814	18.4483	0.3697 (91)
MIT	19.4368	18.8539	18.9004	18.8891	19.4027	19.8448	19.9550	19.9617	19.7024	19.0814	18.4483	18.7861 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4368	18.8539	18.9004	18.8891	19.4027	19.8448	19.9550	19.9617	19.7024	19.0814	18.4483	18.7861 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9963	0.9920	0.9770	0.9336	0.7741	0.5169	0.5565	0.8844	0.9792	0.9947	0.9982	(94)
Useful gains	1236.3333	1387.5293	1515.2010	1630.9479	1605.9027	1351.5621	859.4335	879.1148	1313.3035	1311.0684	1220.7351	1165.6496	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													

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Space heating kWh	6693.6501	6099.1384	5292.2297	4046.0994	2881.9109	1678.9876	904.2779	936.7542	1966.1542	3317.2671	4632.8167	6206.1812	(97)
Space heating requirement - total per year (kWh/year)	4060.2437	3166.2014	2810.1093	1738.9091	949.3501	0.0000	0.0000	0.0000	0.0000	1492.6119	2456.6987	3750.1555	(98a)
Solar heating kWh												20424.2798	
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh	4060.2437	3166.2014	2810.1093	1738.9091	949.3501	0.0000	0.0000	0.0000	0.0000	1492.6119	2456.6987	3750.1555	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												20424.2798	
Space heating per m2												88.9947	(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.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	3493.5399	2684.2888	2686.6933	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.5206	0.6179	0.5930	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1818.7581	1658.5547	1593.1450	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh						1914.4784	1822.3024	1724.5167	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	68.9186	121.8283	97.7405	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(105)
Space cooling kWh						12.8378	22.6935	18.2066	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												53.7379	(107)

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

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

Fraction of space heat from main system(s)													0.0000	(201)
Efficiency of main space heating system 1 (in %)													1.0000	(202)
Efficiency of main space heating system 2 (in %)													363.8602	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(207)
Cooling System Energy Efficiency Ratio (see Table 10c)													0.0000	(208)
													3.3000	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4060.2437	3166.2014	2810.1093	1738.9091	949.3501	0.0000	0.0000	0.0000	0.0000	1492.6119	2456.6987	3750.1555	(98)
Space heating efficiency (main heating system 1)	363.8602	363.8602	363.8602	363.8602	363.8602	0.0000	0.0000	0.0000	0.0000	363.8602	363.8602	363.8602	(210)
Space heating fuel (main heating system)	1115.8800	870.1697	772.3046	477.9058	260.9107	0.0000	0.0000	0.0000	0.0000	410.2157	675.1765	1030.6582	(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	298.6968	264.2023	280.7676	247.0378	239.6039	216.0482	213.3102	221.6815	224.0098	249.6240	265.2360	295.4551	(64)
Efficiency of water heater (217)m	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	(216)
Fuel for water heating, kWh/month	178.4621	157.8527	167.7500	147.5974	143.1559	129.0821	127.4463	132.4479	133.8390	149.1426	158.4703	176.5253	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	3.8902	6.8768	5.5171	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	61.0717	55.1616	61.0717	59.1017	61.0717	59.1017	61.0717	59.1017	59.1017	61.0717	59.1017	61.0717	(231)
Lighting	48.5378	38.9388	35.0601	25.6865	19.8410	16.2103	18.0996	23.5266	30.5587	40.0947	45.2869	49.8868	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-110.5978	-166.1954	-279.7489	-386.0709	-463.6301	-484.1101	-472.6494	-423.1683	-331.5591	-226.7657	-134.4127	-91.6329	(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												5613.2211	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.3727	
Water heating fuel used												1801.7716	(219)
Space cooling fuel												16.2842	(221)

Electricity for pumps and fans:

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)													
mechanical ventilation fans (SFP = 0.9240)												719.0705	(230a)
Total electricity for the above, kWh/year													
Electricity for lighting (calculated in Appendix L)												719.0705	(231)
												391.7278	(232)

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

PV generation													-3570.5413	(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													4971.5340	(238)

Full SAP Calculation Printout



10a. Fuel costs - using BEDF prices (550)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5613.2211	26.0600	1462.8054 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1801.7716	26.0600	469.5417 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Space cooling	16.2842	26.0600	4.2437 (248)
Pumps, fans and electric keep-hot	719.0705	26.0600	187.3898 (249)
Energy for lighting	391.7278	26.0600	102.0843 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3570.5413	26.0600	-930.4831
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-930.4831 (252)
Total energy cost			1295.5818 (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	5613.2211	0.1546	867.7972 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1801.7716	0.1409	253.7995 (264)
Space and water heating			1121.5967 (265)
Space cooling	16.2842	0.1135	1.8481 (266)
Pumps, fans and electric keep-hot	719.0705	0.1387	99.7439 (267)
Energy for lighting	391.7278	0.1443	56.5384 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3570.5413	0.1312	-468.3026
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-468.3026 (269)
Total CO2, kg/year			811.4245 (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	5613.2211	1.5724	8826.0288 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1801.7716	1.5209	2740.2264 (278)
Space and water heating			11566.2553 (279)
Space cooling	16.2842	1.4184	23.0979 (280)
Pumps, fans and electric keep-hot	719.0705	1.5128	1087.8098 (281)
Energy for lighting	391.7278	1.5338	600.8452 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3570.5413	1.4845	-5300.5336
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-5300.5336 (283)
Total Primary energy kWh/year			7977.4746 (286)

SAP 10 EPC IMPROVEMENTS

Post Refurbishment

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

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	+ 1.2	-£ 101	-48 kg (5.9%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£101	0.21 kg/m²	C 79	A 95
Total Savings	£101	0.21 kg/m²		

Potential energy efficiency rating:	C 79
Potential environmental impact rating:	A 95

Fuel prices for cost data on this page from database revision number 550 TEST (28 Jun 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£2226	£2124	£102
Space heating	£1650	£1672	-£22
Space cooling	£4	£4	£0
Water heating	£470	£346	£124
Lighting	£102	£102	£0
Generated (PV)	-£930	-£929	-£1
Total cost of fuels	£1296	£1195	£101
Total cost of uses	£1296	£1195	£101
Delivered energy	22 kWh/m²	20 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes

Full SAP Calculation Printout



CO2 emissions per m² 4 kg/m² 3 kg/m² 0 kg/m²
 Primary energy 35 kWh/m² 32 kWh/m² 2 kWh/m²

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022)
 CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.5600 (1b)	x 2.8500 (2b)	= 192.5460 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Third floor	53.9800 (1e)	x 2.7500 (2e)	= 148.4450 (1e) - (3e)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	229.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 637.8810 (5)

2. Ventilation rate

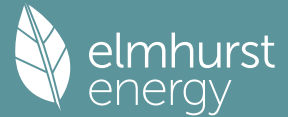
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Number of storeys in the dwelling (ns)	4 (9)
Additional infiltration	[(9) - 1] x 0.1 = 0.3000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0.0000 (12)
If no draught lobby, enter 0.05, else enter 0	0.0500 (13)
Percentage of windows and doors draught stripped	100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.7500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6375 (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	0.8128	0.7969	0.7809	0.7013	0.6853	0.6056	0.6056	0.5897	0.6375	0.6853	0.7172	0.7491 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												83.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.8943	0.8784	0.8624	0.7828	0.7668	0.6871	0.6871	0.6712	0.7190	0.7668	0.7987	0.8306 (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						
New Windows (Uw = 1.40)			40.7200	1.3258	53.9848			(27)					
Solid Door (New)			2.7600	1.4000	3.8640			(26)					
Heatloss Floor 1			53.3000	0.3000	15.9900	110.0000	5863.0000	(28a)					
External Wall 1	177.1600	43.4800	133.6800	0.2900	38.7672	190.0000	25399.2000	(29a)					
External Wall 2	115.1400		115.1400	0.2600	29.9364	190.0000	21876.6000	(29a)					
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200	(30)					
Total net area of external elements Aum(A, m2)			399.5800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	228.9104			(33)					
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000	(32)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		65045.8200	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							283.4241	(35)					
Thermal bridges (Default value 0.200 * total exposed area)							79.9160	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	308.8264	(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	188.2534	184.8986	181.5437	164.7694	161.4146	144.6403	144.6403	141.2855	151.3500	161.4146	168.1243	174.8340	(38)
Average = Sum(39)m / 12 =	497.0799	493.7250	490.3702	473.5959	470.2410	453.4668	453.4668	450.1119	460.1765	470.2410	476.9508	483.6605	(39)
												472.7572	

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HLP	Jan 2.1659	Feb 2.1513	Mar 2.1367	Apr 2.0636	May 2.0490	Jun 1.9759	Jul 1.9759	Aug 1.9613	Sep 2.0051	Oct 2.0490	Nov 2.0782	Dec 2.1075 (40)
HLP (average)												2.0599
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0403 (42)
Hot water usage for mixer showers												65.5439 (42a)
65.7960	64.8072	63.3663	60.6095	58.5750	56.3062	55.0166	56.4466	58.0141	60.4501	63.2661		
Hot water usage for baths												34.0526 (42b)
34.1681	33.6607	32.9461	31.6285	30.6419	29.5479	28.9570	29.6666	30.4392	31.6098	32.9545		
Hot water usage for other uses												48.1742 (42c)
48.1742	46.4224	44.6706	42.9188	41.1671	39.4153	39.4153	41.1671	42.9188	44.6706	46.4224		
Average daily hot water use (litres/day)												136.1356 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	148.1383	144.8902	140.9830	135.1568	130.3840	125.2694	123.3889	127.2803	131.3722	136.7305	142.6431	147.7707 (44)
Energy content (annual)	234.6148	206.3218	216.6856	185.0230	175.5219	154.0334	149.2282	157.5996	161.9950	185.5421	203.2212	231.3731 (45)
Distribution loss	(46)m = 0.15 x (45)m											2261.1597
35.1922	30.9483	32.5028	27.7534	26.3283	23.1050	22.3842	23.6399	24.2993	27.8313	30.4832		34.7060 (46)
Water storage loss:												300.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	37.2980	33.6885	35.0601	25.2664	16.7841	15.8817	16.4111	17.9030	27.4320	35.0601	36.0948	37.2980 (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	298.6968	264.2023	278.5297	236.2093	219.0900	195.8351	192.4233	202.2866	215.3471	247.3861	265.2360	295.4551 (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												632.7371 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												632.7371
Solar input	-0.0000	-16.1885	-59.0069	-81.5369	-106.8103	-98.5447	-97.9034	-85.3308	-58.6389	-28.7766	-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	298.6968	248.0137	219.5228	154.6724	112.2797	97.2904	94.5199	116.9558	156.7082	218.6096	265.2360	295.4551 (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	129.2750	114.9064	121.5232	102.4692	93.2155	84.6575	84.1745	88.1515	96.5450	111.1680	117.1829	128.1971 (65)

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

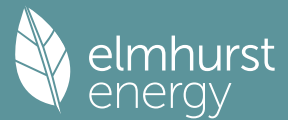
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.4531	49.2530	40.0552	30.3244	22.6678	19.1371	20.6783	26.8785	36.0763	45.8071	53.4637	56.9943 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	594.4551	600.6237	585.0791	551.9864	510.2128	470.9516	444.7226	438.5540	454.0987	487.1914	528.9649	568.2262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820 (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)	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112 (71)
Water heating gains (Table 5)	173.7567	170.9916	163.3377	142.3184	125.2897	117.5798	113.1377	118.4832	134.0903	149.4194	162.7540	172.3080 (72)
Total internal gains	940.7525	937.9559	905.5595	841.7167	775.2579	724.7561	695.6263	701.0033	741.3528	799.5054	862.2702	914.6161 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					21.7300	10.6334	0.5000	0.7000	0.7700	56.0445 (74)		
South					18.9900	46.7521	0.5000	0.7000	0.7700	215.3412 (78)		
Solar gains	271.3856	459.7772	631.2389	800.0741	922.8965	930.7577	891.0968	795.4112	688.1054	507.8844	324.3908	232.7960 (83)
Total gains	1212.1382	1397.7331	1536.7984	1641.7908	1698.1544	1655.5138	1586.7230	1496.4145	1429.4581	1307.3898	1186.6609	1147.4121 (84)

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.3489	36.5958	36.8462	38.1513	38.4235	39.8448	39.8448	40.1418	39.2638	38.4235	37.8829	37.3574	
alpha	3.4233	3.4397	3.4564	3.5434	3.5616	3.6563	3.6563	3.6761	3.6176	3.5616	3.5255	3.4905	
util living area	0.9988	0.9979	0.9961	0.9915	0.9787	0.9405	0.8649	0.8924	0.9686	0.9933	0.9981	0.9991 (86)	
Living	18.4341	18.6233	18.9725	19.4936	20.0024	20.4998	20.7684	20.7261	20.3369	19.6784	19.0048	18.4534	
Non living	16.9782	17.1733	17.5281	18.0788	18.5866	19.0871	19.2885	19.2746	18.9322	18.2708	17.5863	17.0225	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	24	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	7	28	31	0	0	0	0	0	0	0	4	31	
MIT	20.6718	19.6539	19.8517	19.4936	20.0024	20.4998	20.7684	20.7261	20.3369	19.6784	19.1202	19.5577 (87)	
Th 2	19.2250	19.2344	19.2438	19.2913	19.3009	19.3495	19.3495	19.3593	19.3299	19.3009	19.2817	19.2627 (88)	
util rest of house	0.9983	0.9970	0.9941	0.9863	0.9616	0.8748	0.6824	0.7382	0.9322	0.9882	0.9971	0.9987 (89)	
MIT 2	18.9377	18.0670	18.2721	18.0788	18.5866	19.0871	19.2885	19.2746	18.9322	18.2708	17.6844	17.9939 (90)	
Living area fraction									fLA = Living area / (4) =				0.3697 (91)
MIT	19.5787	18.6537	18.8560	18.6018	19.1100	19.6094	19.8356	19.8111	19.4515	18.7911	18.2151	18.5720 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.5787	18.6537	18.8560	18.6018	19.1100	19.6094	19.8356	19.8111	19.4515	18.7911	18.2151	18.5720 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9984	0.9965	0.9935	0.9831	0.9588	0.8893	0.7535	0.7961	0.9362	0.9858	0.9960	0.9984 (94)
Useful gains	1210.2329	1392.8977	1526.7696	1614.0146	1628.2185	1472.3076	1195.5800	1191.3533	1338.2322	1288.8466	1181.9515	1145.6307 (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	7594.7550	6790.5225	6059.0116	4594.7426	3484.4738	2271.5762	1467.2184	1535.3987	2462.6284	3851.8102	5301.3698	6951.1551 (97)
Space heating kWh	4750.0845	3627.2038	3371.9880	2146.1241	1381.0539	0.0000	0.0000	0.0000	0.0000	1906.8449	2965.9811	4319.3102 (98a)
Space heating requirement - total per year (kWh/year)												24468.5906
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	4750.0845	3627.2038	3371.9880	2146.1241	1381.0539	0.0000	0.0000	0.0000	0.0000	1906.8449	2965.9811	4319.3102 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												24468.5906
Space heating per m2												(98c) / (4) = 106.6170 (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	4262.5876	3355.6540	3420.8505	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.4143	0.4941	0.4598	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1766.0778	1658.0203	1572.8800	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1812.6547	1737.1680	1630.7047	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	33.5354	58.8858	43.0216	0.0000	0.0000	0.0000	0.0000 (104)	
Cooled fraction									fc = cooled area / (4) =				0.7451 (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	6.2468	10.9689	8.0138	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												25.2295 (107)	

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 %)												363.3018 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												3.3000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	4750.0845	3627.2038	3371.9880	2146.1241	1381.0539	0.0000	0.0000	0.0000	0.0000	1906.8449	2965.9811	4319.3102 (98)
Space heating efficiency (main heating system 1)	363.3018	363.3018	363.3018	363.3018	363.3018	0.0000	0.0000	0.0000	0.0000	363.3018	363.3018	363.3018 (210)
Space heating fuel (main heating system)	1307.4762	998.3996	928.1507	590.7276	380.1396	0.0000	0.0000	0.0000	0.0000	524.8653	816.3959	1188.9042 (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	298.6968	248.0137	219.5228	154.6724	112.2797	97.2904	94.5199	116.9558	156.7082	218.6096	265.2360	295.4551 (64)
Efficiency of water heater (217)m	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228	167.5228 (216)
Fuel for water heating, kWh/month	178.3021	148.0477	131.0405	92.3291	67.0235	58.0759	56.4221	69.8148	93.5444	130.4954	158.3283	176.3670 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	1.8930	3.3239	2.4284	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	67.8663	61.2986	67.8663	65.6770	67.8663	65.6770	67.8663	67.8663	65.6770	67.8663	65.6770	67.8663 (231)
Lighting	48.5378	38.9388	35.0601	25.6865	19.8410	16.2103	18.0996	23.5266	30.5587	40.0947	45.2869	49.8868 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-98.6636	-164.6105	-280.2234	-375.0342	-462.0857	-449.9257	-444.0127	-389.3678	-306.3206	-210.3207	-117.0174	-82.5656 (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)

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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													6735.0591	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													167.5228	
Water heating fuel used													1359.7908	(219)
Space cooling fuel													7.6453	(221)

Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)														
mechanical ventilation fans (SFP = 0.9240)													719.0705	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													799.0705	(231)
Electricity for lighting (calculated in Appendix L)													391.7278	(232)

Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3380.1480	(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													5913.1455	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6735.0591	16.4900	1110.6112	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1359.7908	16.4900	224.2295	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Space cooling	7.6453	16.4900	1.2607	(248)
Pumps, fans and electric keep-hot	719.0705	16.4900	118.5747	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	391.7278	16.4900	64.5959	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3380.1480	16.4900	-557.3864	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-557.3864	(252)
Total energy cost			975.0777	(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] =	1.2788	(257)
SAP value			79.2708	
SAP rating (Section 12)			79	(258)
SAP band			C	

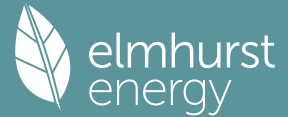
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6735.0591	0.1541	1037.9709	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1359.7908	0.1454	197.7166	(264)
Space and water heating			1235.6876	(265)
Space cooling	7.6453	0.1135	0.8681	(266)
Pumps, fans and electric keep-hot	799.0705	0.1387	110.8409	(267)
Energy for lighting	391.7278	0.1443	56.5384	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-3380.1480	0.1313	-443.9075	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-443.9075	(269)
Total CO2, kg/year			960.0276	(272)
CO2 emissions per m2			4.1800	(273)
EI value			95.3135	
EI rating			95	(274)
EI band			A	

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

1. Overall dwelling characteristics

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.5600 (1b)	x 2.8500 (2b)	= 192.5460 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Third floor	53.9800 (1e)	x 2.7500 (2e)	= 148.4450 (1e) - (3e)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	229.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	637.8810 (5)

2. Ventilation rate

	m ³ per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Number of storeys in the dwelling (ns)		4	(9)
Additional infiltration	[(9) - 1] x 0.1 =	0.3000	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.3500	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0.0000	(12)
If no draught lobby, enter 0.05, else enter 0		0.0500	(13)
Percentage of windows and doors draught stripped		100.0000	(14)
Window infiltration	0.25 - [0.2 * (14) / 100] =	0.0500	(15)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.7500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.6375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500
Adj infilt rate	0.6694	0.6375	0.6375	0.5897	0.5897	0.5259	0.5419	0.5100	0.5259	0.5578	0.5578	0.6056
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000
Effective ac	0.7509	0.7190	0.7190	0.6712	0.6712	0.6074	0.6234	0.5915	0.6074	0.6393	0.6393	0.6871

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
New Windows (Uw = 1.40)			40.7200	1.3258	53.9848		(27)
Solid Door (New)			2.7600	1.4000	3.8640		(26)
Heatloss Floor 1			53.3000	0.3000	15.9900	110.0000	5863.0000
External Wall 1	177.1600	43.4800	133.6800	0.2900	38.7672	190.0000	25399.2000
External Wall 2	115.1400		115.1400	0.2600	29.9364	190.0000	21876.6000
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200
Total net area of external elements Aum(A, m ²)			399.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	228.9104			(33)
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	65045.8200			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				283.4241			(35)
Thermal bridges (Default value 0.200 * total exposed area)				79.9160			(36)
Point Thermal bridges				(36a) =	0.0000		
Total fabric heat loss			(33) + (36) + (36a) =	308.8264			(37)

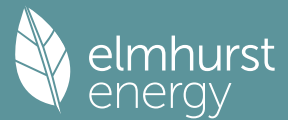
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	158.0597	151.3500	151.3500	141.2855	141.2855	127.8660	131.2209	124.5112	127.8660	134.5757	134.5757	144.6403
Heat transfer coeff	466.8862	460.1765	460.1765	450.1119	450.1119	436.6925	440.0473	433.3376	436.6925	443.4022	443.4022	453.4668
Average = Sum(39)m / 12 =												447.8753
HLP	2.0344	2.0051	2.0051	1.9613	1.9613	1.9028	1.9174	1.8882	1.9028	1.9320	1.9320	1.9759
HLP (average)												1.9515
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0403
Hot water usage for mixer showers	65.7960	64.8072	63.3663	60.6095	58.5750	56.3062	55.0166	56.4466	58.0141	60.4501	63.2661	65.5439
Hot water usage for baths	34.1681	33.6607	32.9461	31.6285	30.6419	29.5479	28.9570	29.6666	30.4392	31.6098	32.9545	34.0526
Hot water usage for other uses	48.1742	46.4224	44.6706	42.9188	41.1671	39.4153	39.4153	41.1671	42.9188	44.6706	46.4224	48.1742
Average daily hot water use (litres/day)												136.1356
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	148.1383	144.8902	140.9830	135.1568	130.3840	125.2694	123.3889	127.2803	131.3722	136.7305	142.6431	147.7707 (44)
Energy content (annual)	234.6148	206.3218	216.6856	185.0230	175.5219	154.0334	149.2282	157.5996	161.9950	185.5421	203.2212	231.3731 (45)
Distribution loss (46)m = 0.15 x (45)m	35.1922	30.9483	32.5028	27.7534	26.3283	23.1050	22.3842	23.6399	24.2993	27.8313	30.4832	34.7060 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss												
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage												
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	37.2980	33.6885	35.0601	25.2664	16.7841	15.8817	16.4111	17.9030	27.4320	35.0601	36.0948	37.2980 (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												
	298.6968	264.2023	278.5297	236.2093	219.0900	195.8351	192.4233	202.2866	215.3471	247.3861	265.2360	295.4551 (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												691.4323 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												691.4323
Solar input	-0.0000	-17.5800	-60.0563	-86.0505	-108.8952	-108.5105	-106.4613	-96.2702	-67.6186	-35.8446	-4.1452	-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												
	298.6968	246.6223	218.4734	150.1589	110.1948	87.3246	85.9621	106.0163	147.7284	211.5416	261.0908	295.4551 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	129.2750	114.9064	121.5232	102.4692	93.2155	84.6575	84.1745	88.1515	96.5450	111.1680	117.1829	128.1971 (65)
Total per year (kWh/year) = Sum(64)m =												2219.2651 (64)
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	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	182.4168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	55.4531	49.2530	40.0552	30.3244	22.6678	19.1371	20.6783	26.8785	36.0763	45.8071	53.4637	56.9943	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	594.4551	600.6237	585.0791	551.9864	510.2128	470.9516	444.7226	438.5540	454.0987	487.1914	528.9649	568.2262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	56.2820	(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)													
	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	-121.6112	(71)
Water heating gains (Table 5)													
	173.7567	170.9916	163.3377	142.3184	125.2897	117.5798	113.1377	118.4832	134.0903	149.4194	162.7540	172.3080	(72)
Total internal gains													
	940.7525	937.9559	905.5595	841.7167	775.2579	724.7561	695.6263	701.0033	741.3528	799.5054	862.2702	914.6161	(73)

6. Solar gains

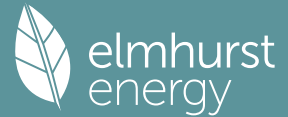
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				21.7300	11.9814	0.5000	0.7000	0.7700	63.1495 (74)			
South				18.9900	50.9848	0.5000	0.7000	0.7700	234.8373 (78)			

Solar gains	297.9869	454.7181	619.3986	815.6684	922.8430	998.6586	944.7191	857.8302	734.0672	536.9413	364.9498	253.1444 (83)
Total gains	1238.7394	1392.6740	1524.9581	1657.3851	1698.1009	1723.4147	1640.3454	1558.8335	1475.4199	1336.4466	1227.2200	1167.7604 (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	38.6995	39.2638	39.2638	40.1418	40.1418	41.3753	41.0599	41.6956	41.3753	40.7492	40.7492	39.8448	
alpha	3.5800	3.6176	3.6176	3.6761	3.6761	3.7584	3.7373	3.7797	3.7584	3.7166	3.7166	3.6563	
util living area													
	0.9986	0.9978	0.9954	0.9884	0.9656	0.8718	0.7109	0.7422	0.9407	0.9900	0.9975	0.9989	(86)
Living	18.7189	18.8904	19.2447	19.7486	20.2692	20.7441	20.9258	20.9135	20.5697	19.9354	19.3010	18.7527	
Non living	17.3200	17.5044	17.8578	18.3784	18.8841	19.3121	19.3841	19.4018	19.1900	18.5792	17.9483	17.3802	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	18	18	0	0	0	0	0	0	0	0	0	0	
16 / 9	13	28	24	0	0	0	0	0	0	0	0	31	
MIT	20.4582	19.8052	19.8340	19.7486	20.2692	20.7441	20.9258	20.9135	20.5697	19.9354	19.3010	19.7272	(87)
Th 2	19.3105	19.3299	19.3299	19.3593	19.3593	19.3989	19.3890	19.4089	19.3989	19.3790	19.3790	19.3495	(88)
util rest of house													
	0.9980	0.9967	0.9930	0.9807	0.9346	0.7273	0.3916	0.4352	0.8661	0.9817	0.9960	0.9984	(89)
MIT 2	18.8377	18.2960	18.3520	18.3784	18.8841	19.3121	19.3841	19.4018	19.1900	18.5792	17.9483	18.2341	(90)
Living area fraction													
MIT	19.4368	18.8539	18.8999	18.8849	19.3961	19.8415	19.9540	19.9607	19.7001	19.0806	18.4483	18.7861	(92)

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Temperature adjustment
adjusted MIT 19.4368 18.8539 18.8999 18.8849 19.3961 19.8415 19.9540 19.9607 19.7001 19.0806 18.4483 0.0000
18.7861 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9963	0.9921	0.9774	0.9356	0.7791	0.5227	0.5624	0.8860	0.9794	0.9947	0.9982	(94)
Useful gains	1236.3333	1387.5293	1512.8735	1619.9744	1588.8235	1342.6455	857.3503	876.6239	1307.2011	1308.8569	1220.7351	1165.6496	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	6693.6501	6099.1384	5291.9644	4044.2198	2878.9656	1677.5493	903.8649	936.2927	1965.1433	3316.8932	4632.8167	6206.1812	(97)
Space heating kWh	4060.2437	3166.2014	2811.6436	1745.4567	959.8657	0.0000	0.0000	0.0000	0.0000	1493.9790	2456.6987	3750.1555	(98a)
Space heating requirement - total per year (kWh/year)												20444.2444	
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	4060.2437	3166.2014	2811.6436	1745.4567	959.8657	0.0000	0.0000	0.0000	0.0000	1493.9790	2456.6987	3750.1555	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												20444.2444	
Space heating per m2										(98c) / (4) =		89.0817	(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.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3493.5399	2684.2888	2686.6933	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5154	0.6121	0.5873	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1800.5415	1643.1141	1577.9949	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1892.0194	1799.8434	1703.6619	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	65.8641	116.6066	93.4963	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =				(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	12.2688	21.7208	17.4160	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												51.4056	(107)

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 %) 363.8602 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c) 3.3000 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4060.2437	3166.2014	2811.6436	1745.4567	959.8657	0.0000	0.0000	0.0000	0.0000	1493.9790	2456.6987	3750.1555	(98)
Space heating efficiency (main heating system 1)	363.8602	363.8602	363.8602	363.8602	363.8602	0.0000	0.0000	0.0000	0.0000	363.8602	363.8602	363.8602	(210)
Space heating fuel (main heating system)	1115.8800	870.1697	772.7263	479.7052	263.8007	0.0000	0.0000	0.0000	0.0000	410.5914	675.1765	1030.6582	(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	298.6968	246.6223	218.4734	150.1589	110.1948	87.3246	85.9621	106.0163	147.7284	211.5416	261.0908	295.4551	(64)
Efficiency of water heater	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	167.3727	(216)
Fuel for water heating, kWh/month	178.4621	147.3492	130.5311	89.7153	65.8380	52.1738	51.3597	63.3415	88.2632	126.3896	155.9937	176.5253	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	3.7178	6.5821	5.2776	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	67.8663	61.2986	67.8663	65.6770	67.8663	65.6770	67.8663	67.8663	65.6770	67.8663	65.6770	67.8663	(231)
Lighting	48.5378	38.9388	35.0601	25.6865	19.8410	16.2103	18.0996	23.5266	30.5587	40.0947	45.2869	49.8868	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-110.5979	-166.1952	-279.7403	-385.9910	-463.2488	-482.3620	-470.9980	-422.1388	-331.2667	-226.7590	-134.4129	-91.6330	(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												5618.7080	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												167.3727	
Water heating fuel used												1325.9424	(219)
Space cooling fuel												15.5775	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9240)
mechanical ventilation fans (SFP = 0.9240) 719.0705 (230a)

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pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	799.0705 (231)
Electricity for lighting (calculated in Appendix L)	391.7278 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3565.3435 (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	4585.6827 (238)

10a. Fuel costs - using BEDF prices (550)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5618.7080	26.0600	1464.2353 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1325.9424	26.0600	345.5406 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Space cooling	15.5775	26.0600	4.0595 (248)
Pumps, fans and electric keep-hot	719.0705	26.0600	187.3898 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	391.7278	26.0600	102.0843 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3565.3435	26.0600	-929.1285
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-929.1285 (252)
Total energy cost			1195.0289 (255)

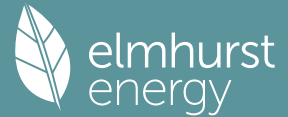
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5618.7080	0.1546	868.5516 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1325.9424	0.1459	193.4981 (264)
Space and water heating			1062.0498 (265)
Space cooling	15.5775	0.1135	1.7678 (266)
Pumps, fans and electric keep-hot	799.0705	0.1387	110.8409 (267)
Energy for lighting	391.7278	0.1443	56.5384 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3565.3435	0.1312	-467.6945
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-467.6945 (269)
Total CO2, kg/year			763.5024 (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	5618.7080	1.5723	8834.3057 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1325.9424	1.5398	2041.7309 (278)
Space and water heating			10876.0366 (279)
Space cooling	15.5775	1.4184	22.0953 (280)
Pumps, fans and electric keep-hot	799.0705	1.5128	1208.8338 (281)
Energy for lighting	391.7278	1.5338	600.8452 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3565.3435	1.4846	-5293.0951
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-5293.0951 (283)
Total Primary energy kWh/year			7414.7159 (286)

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Property Reference	9 Briary Close				Issued on Date	18/07/2024
Assessment Reference	Pre Refurbishment		Prop Type Ref	9 Briary Close		
Property						
SAP Rating	74 C	DER	34.04	TER		
Environmental	65 D	% DER < TER				N/A
CO ₂ Emissions (t/year)	4.83	DFEE	102.66	TFEE		
Compliance Check	See BREL	% DFEE < TFEE				
% DPER < TPER		DPER	179.78	TPER		
Assessor Details	Mr. Jason Cook				Assessor ID	V572-0001
Client	MZA Planning, Charlotte Hirst					

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Ground floor	53.3000 (1b)	x	2.8500 (2b)	=	151.9050 (1b)	- (3b)
First floor	53.9800 (1c)	x	2.7500 (2c)	=	148.4450 (1c)	- (3c)
Second floor	53.9800 (1d)	x	2.7500 (2d)	=	148.4450 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	448.7950	(5)

2. Ventilation rate

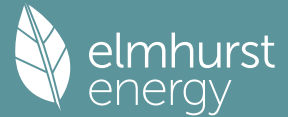
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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) =	0.0668 (8)
Number of storeys in the dwelling (ns)		3 (9)
Additional infiltration	[(9) - 1] x 0.1 =	0.2000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0.0000 (12)
If no draught lobby, enter 0.05, else enter 0		0.0500 (13)
Percentage of windows and doors draught stripped		100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] =	0.0500 (15)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7168 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.6093 (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	0.7769	0.7616	0.7464	0.6703	0.6550	0.5789	0.5789	0.5636	0.6093	0.6550	0.6855	0.7159 (22b)
Effective ac	0.8018	0.7901	0.7786	0.7246	0.7145	0.6675	0.6675	0.6588	0.6856	0.7145	0.7349	0.7563 (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	
Original Windows (Uw = 2.80)			37.6000	2.5180	94.6763			(27)
Solid Door (Old)			2.7600	2.8000	7.7280			(26)
Heatloss Floor 1			53.3000	0.4000	21.3200	110.0000	5863.0000	(28a)
External Wall 1	92.1800	40.3600	51.8200	0.8200	42.4924	190.0000	9845.8000	(29a)
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200	(30)
Total net area of external elements Aum(A, m ²)			199.4600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	252.5847			(33)
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000	(32)

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Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 27615.8200 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 171.2503 (35)
Thermal bridges (Default value 0.200 * total exposed area) 39.8920 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 292.4767 (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	118.7444	117.0089	115.3078	107.3176	105.8227	98.8636	98.8636	97.5748	101.5441	105.8227	108.8469	112.0086 (38)
Average = $\text{Sum}(39)m / 12 =$	411.2210	409.4855	407.7844	399.7943	398.2994	391.3402	391.3402	390.0515	394.0208	398.2994	401.3236	404.4853 (39)
												399.7871
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	2.5500	2.5393	2.5287	2.4792	2.4699	2.4268	2.4268	2.4188	2.4434	2.4699	2.4887	2.5083 (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												
Hot water usage for mixer showers												2.9507 (42)
Hot water usage for baths	64.4812	63.5122	62.1002	59.3984	57.4046	55.1811	53.9173	55.3187	56.8549	59.2422	62.0020	64.2342 (42a)
Hot water usage for other uses	33.4880	32.9906	32.2902	30.9989	30.0320	28.9598	28.3806	29.0761	29.8333	30.9806	32.2985	33.3747 (42b)
Average daily hot water use (litres/day)	47.2082	45.4915	43.7749	42.0582	40.3416	38.6249	38.6249	40.3416	42.0582	43.7749	45.4915	47.2082 (42c)
												133.4147 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	145.1774	141.9944	138.1653	132.4555	127.7781	122.7658	120.9228	124.7363	128.7464	133.9977	139.7920	144.8171 (44)
Distribution loss (46)m = 0.15 x (45)m	229.9255	202.1981	212.3549	181.3250	172.0139	150.9549	146.2457	154.4497	158.7572	181.8336	199.1594	226.7486 (45)
Water storage loss:												
Store volume	34.4888	30.3297	31.8532	27.1988	25.8021	22.6432	21.9369	23.1674	23.8136	27.2750	29.8739	34.0123 (46)
a) If manufacturer declared loss factor is known (kWh/day):												250.0000 (47)
Temperature factor from Table 2b												2.0900 (48)
Enter (49) or (54) in (55)												0.7800 (49)
Total storage loss												1.6302 (55)
If cylinder contains dedicated solar storage	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (56)
Primary loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (57)
Combi loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	37.2980	36.0948	106.3213	102.8916	106.3213 (59)
Total heat required for water heating calculated for each 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 (61)
WWHRS	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (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	161.5073	144.0566	155.6651	142.6039	142.2517	79.0683	78.4651	81.1929	81.6626	145.5167	148.5338	160.4510 (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	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334	147.5334 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	167.2206	185.6906	167.7206	173.3112	167.7206	173.3112	167.7206	167.7206	173.3112	167.7206	173.3112	167.7206 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	332.5248	335.9753	327.2800	308.7687	285.4015	263.4397	248.7678	245.3172	254.0125	272.5238	295.8910	317.8529 (68)
Pumps, fans	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533	37.7533 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267 (71)
Total internal gains	217.0797	214.3699	209.2272	198.0609	191.1985	109.8171	105.4638	109.1302	113.4203	195.5870	206.2969	215.6599 (72)
	787.5850	806.2959	774.4878	750.4009	714.5806	613.8281	589.2122	589.4280	608.0041	706.0914	745.7592	771.4934 (73)

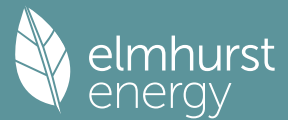
6. Solar gains

[Jan]												Gains	
						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			W
North						15.4400	10.6334	0.7600	0.7000	0.7700			60.5291 (74)
South						22.1600	46.7521	0.7600	0.7000	0.7700			381.9578 (78)
Solar gains	442.4869	741.2227	993.3965	1216.3233	1363.7892	1358.4654	1307.5280	1194.2250	1068.7184	812.4077	527.4207	380.5067 (83)	
Total gains	1230.0719	1547.5186	1767.8843	1966.7242	2078.3698	1972.2934	1896.7402	1783.6530	1676.7225	1518.4991	1273.1799	1152.0001 (84)	

7. Mean internal temperature (heating season)

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

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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	18.6543	18.7334	18.8116	19.1875	19.2595	19.6020	19.6020	19.6668	19.4687	19.2595	19.1144	18.9650
alpha	2.2436	2.2489	2.2541	2.2792	2.2840	2.3068	2.3068	2.3111	2.2979	2.2840	2.2743	2.2643
util living area	0.9826	0.9703	0.9530	0.9195	0.8621	0.7758	0.6632	0.7000	0.8416	0.9335	0.9730	0.9850 (86)
MIT	17.2608	17.6293	18.1953	18.9724	19.7176	20.3413	20.6864	20.6307	20.1189	19.1730	18.1002	17.2310 (87)
Th 2	18.9918	18.9980	19.0041	19.0330	19.0385	19.0640	19.0640	19.0688	19.0541	19.0385	19.0275	19.0160 (88)
util rest of house	0.9775	0.9616	0.9380	0.8907	0.8032	0.6543	0.4496	0.4995	0.7478	0.9036	0.9634	0.9806 (89)
MIT 2	15.7941	16.1611	16.7218	17.4938	18.1979	18.7555	18.9887	18.9672	18.5837	17.7049	16.6485	15.7780 (90)
Living area fraction									FLA = Living area / (4) =			0.4379 (91)
MIT	16.4363	16.8040	17.3670	18.1412	18.8633	19.4499	19.7321	19.6956	19.2559	18.3477	17.2841	16.4142 (92)
Temperature adjustment												0.0000
adjusted MIT	16.4363	16.8040	17.3670	18.1412	18.8633	19.4499	19.7321	19.6956	19.2559	18.3477	17.2841	16.4142 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9671	0.9470	0.9202	0.8728	0.7964	0.6841	0.5369	0.5780	0.7604	0.8886	0.9504	0.9714 (94)
Useful gains	1189.6111	1465.5367	1626.8940	1716.4961	1655.1319	1349.2094	1018.3901	1031.0242	1275.0412	1349.3236	1210.0214	1119.0286 (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	4990.7089	4874.4982	4431.3759	3694.5888	2853.1416	1897.9419	1225.6997	1285.4428	2031.5320	3085.9057	4087.1339	4940.4662 (97)
Space heating kWh	2828.0167	2290.8221	2086.5346	1424.2268	891.3192	0.0000	0.0000	0.0000	0.0000	1292.0171	2071.5210	2843.1496 (98a)
Space heating requirement - total per year (kWh/year)												15727.6070
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	2828.0167	2290.8221	2086.5346	1424.2268	891.3192	0.0000	0.0000	0.0000	0.0000	1292.0171	2071.5210	2843.1496 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15727.6070
Space heating per m2										(98c) / (4) =		97.5295 (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	3678.5980	2895.9175	2964.3912	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5129	0.5878	0.5566	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1886.6656	1702.3418	1649.8548	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2228.0459	2144.0732	2017.4635	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	245.7938	328.6482	273.5009	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			0.5271 (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	32.3894	43.3075	36.0405	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												111.7375 (107)

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 %)												74.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												3.2000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2828.0167	2290.8221	2086.5346	1424.2268	891.3192	0.0000	0.0000	0.0000	0.0000	1292.0171	2071.5210	2843.1496 (98)
Space heating efficiency (main heating system 1)	74.3000	74.3000	74.3000	74.3000	74.3000	0.0000	0.0000	0.0000	0.0000	74.3000	74.3000	74.3000 (210)
Space heating fuel (main heating system)	3806.2136	3083.2060	2808.2565	1916.8597	1199.6220	0.0000	0.0000	0.0000	0.0000	1738.9194	2788.0498	3826.5808 (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	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (64)
Efficiency of water heater (217)m	72.9315	72.8176	72.5972	72.1651	71.2986	64.2000	64.2000	64.2000	64.2000	71.9668	72.6579	69.2000 (216)
Fuel for water heating, kWh/month	530.3374	472.2427	508.5764	461.6120	461.2596	367.5322	364.6104	377.3891	379.6854	470.6211	483.0265	72.9475 (217)
Space cooling fuel requirement												525.8661 (219)
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	10.1217	13.5336	11.2627	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	57.1954	45.8842	41.3137	30.2682	23.3800	19.1017	21.3280	27.7230	36.0094	47.2463	53.3646	58.7850 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-61.5647	-86.1831	-122.9093	-136.6707	-145.6379	-135.1274	-133.4795	-127.0508	-115.0342	-98.0696	-67.4840	-53.2854 (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)												

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(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												21167.7079	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												69.2000	
Water heating fuel used												5402.7588	(219)
Space cooling fuel												34.9180	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.5993	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1282.4966	(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												25870.4875	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	21167.7079	0.2100	4445.2187	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)	5402.7588	0.2100	1134.5794	(264)
Space and water heating			5579.7980	(265)
Space cooling	34.9180	0.1139	3.9783	(266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	461.5993	0.1443	66.6230	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1282.4966	0.1348	-172.9060	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-172.9060	(269)
Total CO ₂ , kg/year			5489.4226	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			34.0400	(273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	21167.7079	1.1300	23919.5099	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)	5402.7588	1.1300	6105.1175	(278)
Space and water heating			30024.6274	(279)
Space cooling	34.9180	1.4200	49.5819	(280)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	461.5993	1.5338	708.0165	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1282.4966	1.4983	-1921.5463	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1921.5463	(283)
Total Primary energy kWh/year			28990.7802	(286)
Dwelling Primary energy Rate (DPER)			179.7800	(287)

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING

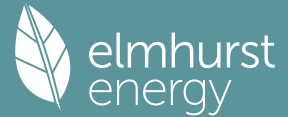
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	53.3000 (1b)	x 2.8500 (2b)	= 151.9050 (1b) - (3b)	
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)	
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2600		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	448.7950 (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)

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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) =		0.0668 (8)	
Number of storeys in the dwelling (ns)													3 (9)	
Additional infiltration											[(9) - 1] x 0.1 =		0.2000 (10)	
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction													0.3500 (11)	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0													0.0000 (12)	
If no draught lobby, enter 0.05, else enter 0													0.0500 (13)	
Percentage of windows and doors draught stripped													100.0000 (14)	
Window infiltration											0.25 - [0.2 * (14) / 100] =		0.0500 (15)	
Pressure test													No	
Pressure Test Method													Blower Door	
Measured/design AP50													15.0000 (17)	
Infiltration rate													0.7168 (18)	
Number of sides sheltered													2 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.8500 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.6093 (21)	

3. Heat losses and heat loss parameter														

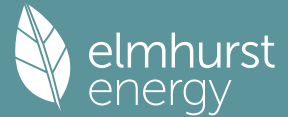
Element	Gross m2		Openings m2		NetArea m2		U-value W/m2K		A x U W/K		K-value kJ/m2K		A x K kJ/K	
Original Windows (Uw = 2.80)					37.6000		2.5180		94.6763				(27)	
Solid Door (Old)					2.7600		2.8000		7.7280				(26)	
Heatloss Floor 1					53.3000		0.4000		21.3200		110.0000		5863.0000 (28a)	
External Wall 1	92.1800		40.3600		51.8200		0.8200		42.4924		190.0000		9845.8000 (29a)	
External Roof 1	53.9800				53.9800		1.6000		86.3680		9.0000		485.8200 (30)	
Total net area of external elements Aum(A, m2)					199.4600								(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		252.5847						(33)	
Party Wall 1					163.1600		0.0000		0.0000		70.0000		11421.2000 (32)	
Heat capacity Cm = Sum(A x k)									(28)...(30) + (32) + (32a)...(32e) =		27615.8200		(34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													171.2503 (35)	
Thermal bridges (Default value 0.200 * total exposed area)													39.8920 (36)	
Point Thermal bridges											(36a) =		0.0000	
Total fabric heat loss									(33) + (36) + (36a) =		292.4767		(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		
	118.7444	117.0089	115.3078	107.3176	105.8227	98.8636	98.8636	97.5748	101.5441	105.8227	108.8469	112.0086		
Heat transfer coeff														
	411.2210	409.4855	407.7844	399.7943	398.2994	391.3402	391.3402	390.0515	394.0208	398.2994	401.3236	404.4853		
Average = Sum(39)m / 12 =	399.7871 (39)													
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	2.5500	2.5393	2.5287	2.4792	2.4699	2.4268	2.4268	2.4188	2.4434	2.4699	2.4887	2.5083		
HLP (average)	2.4791 (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	2.9507 (42)													
Hot water usage for mixer showers	64.4812	63.5122	62.1002	59.3984	57.4046	55.1811	53.9173	55.3187	56.8549	59.2422	62.0020	64.2342		
Hot water usage for baths	33.4880	32.9906	32.2902	30.9989	30.0320	28.9598	28.3806	29.0761	29.8333	30.9806	32.2985	33.3747		
Hot water usage for other uses	47.2082	45.4915	43.7749	42.0582	40.3416	38.6249	38.6249	40.3416	42.0582	43.7749	45.4915	47.2082		
Average daily hot water use (litres/day)	133.4147 (43)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	145.1774	141.9944	138.1653	132.4555	127.7781	122.7658	120.9228	124.7363	128.7464	133.9977	139.7920	144.8171		
Energy conte	229.9255	202.1981	212.3549	181.3250	172.0139	150.9549	146.2457	154.4497	158.7572	181.8336	199.1594	226.7486		
Energy content (annual)	Total = Sum(45)m = 2215.9665 (45)													
Distribution loss (46)m = 0.15 x (45)m	34.4888	30.3297	31.8532	27.1988	25.8021	22.6432	21.9369	23.1674	23.8136	27.2750	29.8739	34.0123		
Water storage loss:														
Store volume	250.0000 (47)													
a) If manufacturer declared loss factor is known (kWh/day):	2.0900 (48)													
Temperature factor from Table 2b	0.7800 (49)													
Enter (49) or (54) in (55)	1.6302 (55)													
Total storage loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362		
If cylinder contains dedicated solar storage	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362		
Primary loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	37.2980	36.0948	106.3213	102.8916	106.3213		
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Total heat required for water heating calculated for each month	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062		
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
Output from w/h	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062		
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		
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	3791.1970 (64)													
Heat gains from water heating, kWh/month	161.5073	144.0566	155.6651	142.6039	142.2517	79.0683	78.4651	81.1929	81.6626	145.5167	148.5338	160.4510		

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.3442	58.0381	47.1998	35.7333	26.7110	22.5506	24.3667	31.6727	42.5111	53.9776	62.9998	67.1603 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	496.3056	501.4557	488.4776	460.8488	425.9724	393.1935	371.2952	366.1451	379.1232	406.7520	441.6284	474.4073 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267 (71)
Water heating gains (Table 5)	217.0797	214.3699	209.2272	198.0609	191.1985	109.8171	105.4638	109.1302	113.4203	195.5870	206.2969	215.6599 (72)
Total internal gains	896.3975	891.5318	862.5727	812.3110	761.5500	640.2293	615.7937	621.6161	649.7226	773.9846	828.5932	874.8955 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					15.4400	10.6334		0.7600	0.7000	0.7700		60.5291 (74)
South					22.1600	46.7521		0.7600	0.7000	0.7700		381.9578 (78)
Solar gains	442.4869	741.2227	993.3965	1216.3233	1363.7892	1358.4654	1307.5280	1194.2250	1068.7184	812.4077	527.4207	380.5067 (83)
Total gains	1338.8844	1632.7544	1855.9691	2028.6344	2125.3392	1998.6946	1923.3218	1815.8411	1718.4410	1586.3924	1356.0139	1255.4023 (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	18.6543	18.7334	18.8116	19.1875	19.2595	19.6020	19.6020	19.6668	19.4687	19.2595	19.1144	18.9650
alpha	2.2436	2.2489	2.2541	2.2792	2.2840	2.3068	2.3068	2.3111	2.2979	2.2840	2.2743	2.2643
util living area	0.9794	0.9670	0.9485	0.9150	0.8571	0.7717	0.6582	0.6938	0.8356	0.9280	0.9694	0.9821 (86)
MIT	17.3285	17.6805	18.2454	19.0043	19.7377	20.3497	20.6918	20.6383	20.1356	19.2096	18.1508	17.2964 (87)
Th 2	18.9918	18.9980	19.0041	19.0330	19.0385	19.0640	19.0688	19.0541	19.0541	19.0385	19.0275	19.0160 (88)
util rest of house	0.9733	0.9574	0.9323	0.8849	0.7969	0.6494	0.4447	0.4929	0.7398	0.8961	0.9586	0.9769 (89)
MIT 2	15.8607	16.2109	16.7695	17.5229	18.2142	18.7606	18.9904	18.9700	18.5955	17.7380	16.6975	15.8424 (90)
Living area fraction	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	19.2698	18.3824	17.3338	16.4791 (91)
MIT	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	19.2698	18.3824	17.3338	16.4791 (92)
Temperature adjustment	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	19.2698	18.3824	17.3338	16.4791 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9616	0.9419	0.9138	0.8670	0.7907	0.6798	0.5321	0.5719	0.7535	0.8811	0.9447	0.9664 (94)
Useful gains	1287.5319	1537.9653	1696.0585	1758.7747	1680.4552	1358.7895	1023.4513	1038.4581	1294.9177	1397.7665	1280.9596	1213.2624 (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	5018.3084	4895.1327	4451.2733	3706.7110	2860.3061	1900.5050	1226.9996	1287.3583	2037.0243	3099.7245	4107.0762	4966.6955 (97)
Space heating kWh	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98a)
Space heating requirement - total per year (kWh/year)												15455.5321
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	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15455.5321
Space heating per m ²												95.8423 (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	3678.5980	2895.9175	2964.3912	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5129	0.5878	0.5566	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1886.6656	1702.3418	1649.8548	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2228.0459	2144.0732	2017.4635	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	245.7938	328.6482	273.5009	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			0.5271 (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	32.3894	43.3075	36.0405	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												111.7375 (107)

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 %)												74.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												3.2000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98)
Space heating efficiency (main heating system 1)	74.3000	74.3000	74.3000	74.3000	74.3000	0.0000	0.0000	0.0000	0.0000	74.3000	74.3000	74.3000 (210)
Space heating fuel (main heating system)	3735.7977	3036.3614	2758.9231	1887.6367	1181.4389	0.0000	0.0000	0.0000	0.0000	1704.2486	2738.6325	3758.4848 (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	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (64)
Efficiency of water heater (217)m	72.9093	72.7981	72.5720	72.1391	71.2662	64.2000	64.2000	64.2000	64.2000	71.9305	72.6332	69.2000 (216)
Fuel for water heating, kWh/month	530.4991	472.3690	508.7533	461.7782	461.4688	367.5322	364.6104	377.3891	379.6854	470.8588	483.1910	72.9263 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	10.1217	13.5336	11.2627	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	57.1954	45.8842	41.3137	30.2682	23.3800	19.1017	21.3280	27.7230	36.0094	47.2463	53.3646	58.7850 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.5647	-86.1831	-122.9093	-136.6707	-145.6379	-135.1274	-133.4795	-127.0508	-115.0342	-98.0696	-67.4840	-53.2854 (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												20801.5237 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												69.2000
Water heating fuel used												5404.1541 (219)
Space cooling fuel												34.9180 (221)
Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												461.5993 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1282.4966 (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												25505.6986 (238)
10a. Fuel costs - using Table 12 prices												
		Fuel		Fuel price		Fuel cost						
		kWh/year		p/kWh		£/year						
Space heating - main system 1		20801.5237		3.6400		757.1755 (240)						
Total CO2 associated with community systems						0.0000 (473)						
Water heating (other fuel)		5404.1541		3.6400		196.7112 (247)						
Energy for instantaneous electric shower(s)		0.0000		16.4900		0.0000 (247a)						
Space cooling		34.9180		16.4900		5.7580 (248)						
Pumps, fans and electric keep-hot		86.0000		16.4900		14.1814 (249)						
Energy for lighting		461.5993		16.4900		76.1177 (250)						
Additional standing charges						92.0000 (251)						
Energy saving/generation technologies												
PV Unit electricity used in dwelling		-1282.4966		16.4900		-211.4837						
PV Unit electricity exported		0.0000		5.5900		0.0000						
Total						-211.4837 (252)						
Total energy cost						930.4601 (255)						
11a. SAP rating - Individual heating systems												
Energy cost deflator (Table 12):						0.3600 (256)						
Energy cost factor (ECF)						1.6240 (257)						
SAP value						73.6750						
SAP rating (Section 12)						74 (258)						
SAP band						C						
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP												

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	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	20801.5237	0.2100	4368.3200 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	5404.1541	0.2100	1134.8724 (264)
Space and water heating			5503.1924 (265)
Space cooling	34.9180	0.1139	3.9783 (266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	461.5993	0.1443	66.6230 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1282.4966	0.1348	-172.9060
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-172.9060 (269)
Total CO ₂ , kg/year			5412.8169 (272)
CO ₂ emissions per m ²			33.5700 (273)
EI value			64.8348
EI rating			65 (274)
EI band			D

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3000 (1b)	x 2.8500 (2b)	= 151.9050 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 448.7950 (5)

2. Ventilation rate

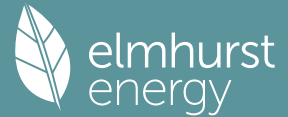
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.0668 (8)
Number of storeys in the dwelling (ns)	3 (9)
Additional infiltration	[(9) - 1] x 0.1 = 0.2000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0.0000 (12)
If no draught lobby, enter 0.05, else enter 0	0.0500 (13)
Percentage of windows and doors draught stripped	100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.7168 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6093 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.6398	0.6093	0.6093	0.5636	0.5636	0.5027	0.5179	0.4875	0.5027	0.5332	0.5332	0.5789 (22b)
Effective ac	0.7047	0.6856	0.6856	0.6588	0.6588	0.6263	0.6341	0.6188	0.6263	0.6421	0.6421	0.6675 (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
Original Windows (Uw = 2.80)			37.6000	2.5180	94.6763		(27)
Solid Door (Old)			2.7600	2.8000	7.7280		(26)
Heatloss Floor 1			53.3000	0.4000	21.3200	110.0000	5863.0000 (28a)
External Wall 1		40.3600	51.8200	0.8200	42.4924	190.0000	9845.8000 (29a)
External Roof 1	92.1800		53.9800	1.6000	86.3680	9.0000	485.8200 (30)
Total net area of external elements Aum(A, m ²)			199.4600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	252.5847			(33)
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000 (32)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	27615.8200			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							171.2503 (35)
Thermal bridges (Default value 0.200 * total exposed area)							39.8920 (36)
Point Thermal bridges						(36a) =	0.0000

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Total fabric heat loss (33) + (36) + (36a) = 292.4767 (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	104.3621	101.5441	101.5441	97.5748	97.5748	92.7636	93.9148	91.6467	92.7636	95.1005	95.1005	98.8636 (38)
Heat transfer coeff	396.8388	394.0208	394.0208	390.0515	390.0515	385.2402	386.3915	384.1233	385.2402	387.5771	387.5771	391.3402 (39)
Average = Sum(39)m / 12 =												389.3727

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	2.4609	2.4434	2.4434	2.4188	2.4188	2.3889	2.3961	2.3820	2.3889	2.4034	2.4034	2.4268 (40)
HLP (average)												2.4146
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9507 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	64.4812	63.5122	62.1002	59.3984	57.4046	55.1811	53.9173	55.3187	56.8549	59.2422	62.0020	64.2342 (42a)
Hot water usage for baths	33.4880	32.9906	32.2902	30.9989	30.0320	28.9598	28.3806	29.0761	29.8333	30.9806	32.2985	33.3747 (42b)
Hot water usage for other uses	47.2082	45.4915	43.7749	42.0582	40.3416	38.6249	38.6249	40.3416	42.0582	43.7749	45.4915	47.2082 (42c)
Average daily hot water use (litres/day)												133.4147 (43)

Daily hot water use

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.1774	141.9944	138.1653	132.4555	127.7781	122.7658	120.9228	124.7363	128.7464	133.9977	139.7920	144.8171 (44)
Energy conte	229.9255	202.1981	212.3549	181.3250	172.0139	150.9549	146.2457	154.4497	158.7572	181.8336	199.1594	226.7486 (45)
Energy content (annual)												Total = Sum(45)m = 2215.9665
Distribution loss (46)m = 0.15 x (45)m												
Distribution loss	34.4888	30.3297	31.8532	27.1988	25.8021	22.6432	21.9369	23.1674	23.8136	27.2750	29.8739	34.0123 (46)

Water storage loss:

Store volume 250.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.0900 (48)

Temperature factor from Table 2b 0.7800 (49)

Enter (49) or (54) in (55) 1.6302 (55)

Total storage loss

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total storage loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (56)

If cylinder contains dedicated solar storage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
If cylinder contains dedicated solar storage	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (57)

Primary loss 106.3213 96.0322 106.3213 102.8916 106.3213 36.0948 37.2980 37.2980 36.0948 106.3213 102.8916 106.3213 (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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total heat required for water heating calculated for each month	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from w/h	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062 (64)
Total per year (kWh/year) = Sum(64)m =												3791.1970 (64)

Electric shower(s)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat gains from water heating, kWh/month	161.5073	144.0566	155.6651	142.6039	142.2517	79.0683	78.4651	81.1929	81.6626	145.5167	148.5338	160.4510 (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
Metabolic gains (Table 5), Watts	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401 (66)

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

	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	65.3442	58.0381	47.1998	35.7333	26.7110	22.5506	24.3667	31.6727	42.5111	53.9776	62.9998	67.1603 (67)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	496.3056	501.4557	488.4776	460.8488	425.9724	393.1935	371.2952	366.1451	379.1232	406.7520	441.6284	474.4073 (68)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547 (69)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Losses e.g. evaporation (negative values) (Table 5)	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267 (71)

Water heating gains (Table 5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water heating gains (Table 5)	217.0797	214.3699	209.2272	198.0609	191.1985	109.8171	105.4638	109.1302	113.4203	195.5870	206.2969	215.6599 (72)

Total internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total internal gains	896.3975	891.5318	862.5727	812.3110	761.5500	640.2293	615.7937	621.6161	649.7226	773.9846	828.5932	874.8955 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	15.4400	11.9814	0.7600	0.7000	0.7700	68.2026 (74)
South	22.1600	50.9848	0.7600	0.7000	0.7700	416.5389 (78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar gains	484.7415	730.5452	969.7604	1232.5036	1356.0656	1450.2136	1378.8424	1280.2094	1133.6186	855.3747	591.8165	412.9324 (83)
Total gains	1381.1390	1622.0770	1832.3331	2044.8146	2117.6156	2090.4429	1994.6361	1901.8255	1783.3412	1629.3593	1420.4096	1287.8280 (84)

7. Mean internal temperature (heating season)

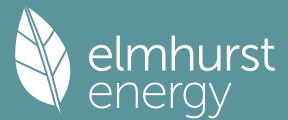
Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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	19.3304	19.4687	19.4687	19.6668	19.6668	19.9124	19.8531	19.9703	19.9124	19.7923	19.7923	19.6020
alpha	2.2887	2.2979	2.2979	2.3111	2.3111	2.3275	2.3235	2.3314	2.3275	2.3195	2.3195	2.3068

util living area

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	0.9757	0.9642	0.9424	0.8983	0.8185	0.6704	0.5107	0.5385	0.7737	0.9081	0.9613	0.9789 (86)
MIT	17.6672	17.9652	18.5529	19.3127	20.0611	20.6428	20.8782	20.8602	20.4183	19.5314	18.5067	17.6466 (87)
Th 2	19.0438	19.0541	19.0541	19.0688	19.0688	19.0866	19.0824	19.0908	19.0866	19.0779	19.0779	19.0640 (88)
util rest of house												
	0.9684	0.9534	0.9235	0.8604	0.7358	0.4909	0.2232	0.2522	0.6363	0.8649	0.9472	0.9725 (89)
MIT 2	16.2256	16.5242	17.1003	17.8390	18.5212	18.9758	19.0745	19.0798	18.8399	18.0672	17.0767	16.2170 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	16.8568	17.1552	17.7363	18.4843	19.1955	19.7057	19.8643	19.8594	19.5310	18.7083	17.7029	16.8430 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8568	17.1552	17.7363	18.4843	19.1955	19.7057	19.8643	19.8594	19.5310	18.7083	17.7029	16.8430 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9558	0.9379	0.9054	0.8452	0.7426	0.5589	0.3545	0.3827	0.6759	0.8536	0.9323	0.9612	(94)
Useful gains	1320.0679	1521.2716	1659.0749	1728.3219	1572.5338	1168.4160	707.0848	727.8912	1205.3057	1390.7418	1324.2224	1237.8112	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	4665.5700	4552.9784	4072.7186	3348.3101	2416.5604	1427.5951	758.9753	791.0649	1668.4908	2755.0141	3760.6121	4595.5000	(97)
Space heating kWh													
	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98a)
Space heating requirement - total per year (kWh/year)												13383.7982	
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													
	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13383.7982	
Space heating per m2												82.9952	(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.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	3081.9217	2356.9880	2381.5645	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5980	0.6791	0.6578	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1843.1404	1600.6750	1566.6453	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2335.2841	2227.4276	2117.9647	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	354.3434	466.3040	410.1817	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =				(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	46.6935	61.4471	54.0516	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												162.1922	(107)

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 %)													74.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)													3.2000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98)
Space heating efficiency (main heating system 1)													
	74.3000	74.3000	74.3000	74.3000	74.3000	0.0000	0.0000	0.0000	0.0000	74.3000	74.3000	74.3000	(210)
Space heating fuel (main heating system)													
	3350.0048	2742.0012	2416.8922	1569.8405	845.1626	0.0000	0.0000	0.0000	0.0000	1366.1085	2360.9698	3362.2079	(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													
	386.7830	343.8759	369.2124	333.1226	328.8714	235.9557	234.0799	242.2838	243.7580	338.6911	350.9570	383.6062	(64)
Efficiency of water heater (217)m													
	72.7733	72.6630	72.3741	71.8095	70.5119	64.2000	64.2000	64.2000	64.2000	71.5062	72.4163	72.7887	(216)
Fuel for water heating, kWh/month													
	531.4902	473.2473	510.1445	463.8976	466.4057	367.5322	364.6104	377.3891	379.6854	473.6526	484.6383	527.0137	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	14.5917	19.2022	16.8911	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	57.1954	45.8842	41.3137	30.2682	23.3800	19.1017	21.3280	27.7230	36.0094	47.2463	53.3646	58.7850	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-67.0847	-86.7394	-122.7966	-138.6066	-145.8675	-138.7384	-136.5146	-131.4380	-119.5589	-102.6347	-74.4509	-57.7386	(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												18013.1874	(211)

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Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	69.2000	
Water heating fuel used	5419.7069	(219)
Space cooling fuel	50.6851	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	461.5993	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1322.1689	(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	22709.0097	(238)

10a. Fuel costs - using BEDF prices (550)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	18013.1874	5.6000	1008.7385 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	5419.7069	5.6000	303.5036 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Space cooling	50.6851	26.0600	13.2085 (248)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116 (249)
Energy for lighting	461.5993	26.0600	120.2928 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1322.1689	26.0600	-344.5572
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-344.5572 (252)
Total energy cost			1222.5978 (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	18013.1874	0.2100	3782.7694 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	5419.7069	0.2100	1138.1384 (264)
Space and water heating			4920.9078 (265)
Space cooling	50.6851	0.1139	5.7743 (266)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	461.5993	0.1443	66.6230 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1322.1689	0.1349	-178.3970
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-178.3970 (269)
Total CO2, kg/year			4826.8374 (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	18013.1874	1.1300	20354.9018 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	5419.7069	1.1300	6124.2688 (278)
Space and water heating			26479.1705 (279)
Space cooling	50.6851	1.4199	71.9690 (280)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	461.5993	1.5338	708.0165 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1322.1689	1.4987	-1981.5039
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1981.5039 (283)
Total Primary energy kWh/year			25407.7529 (286)

SAP 10 EPC IMPROVEMENTS

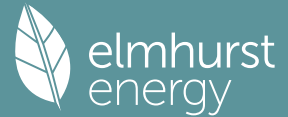
Pre Refurbishment

Current energy efficiency rating:	C 74
Current environmental impact rating:	D 65

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	
N Solar water heating	SAP change + 1.0 Cost change -£ 62 CO2 change -289 kg (6.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
----------------------	------------------------	-------------------	----------------------

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Solar water heating Total Savings £62 1.79 kg/m² C 75 D 67
£62 1.79 kg/m²

Potential energy efficiency rating: C 75
Potential environmental impact rating: D 67

Fuel prices for cost data on this page from database revision number 550 TEST (28 Jun 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£156	£177	-£21
Mains gas	£1411	£1332	£80
Space heating	£1130	£1151	-£21
Space cooling	£13	£13	£0
Water heating	£304	£224	£80
Lighting	£120	£120	£0
Generated (PV)	-£345	-£348	£3
Total cost of fuels	£1222	£1161	£62
Total cost of uses	£1222	£1160	£62
Delivered energy	141 kWh/m ²	132 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	4.8 tonnes	4.5 tonnes	0.3 tonnes
CO2 emissions per m ²	30 kg/m ²	28 kg/m ²	2 kg/m ²
Primary energy	158 kWh/m ²	148 kWh/m ²	9 kWh/m ²

SAP 10 WORKSHEET FOR Existing dwelling (SAP) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3000 (1b)	x 2.8500 (2b)	= 151.9050 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 448.7950 (5)

2. Ventilation rate

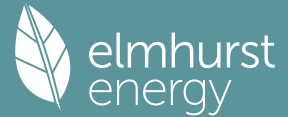
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0668 (8)
Number of storeys in the dwelling (ns)	3 (9)
Additional infiltration	[(9) - 1] x 0.1 = 0.2000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0.0000 (12)
If no draught lobby, enter 0.05, else enter 0	0.0500 (13)
Percentage of windows and doors draught stripped	100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] = 0.0500 (15)
Pressure test	No
Pressure Test Method	Blower Door
Measured/design AP50	15.0000 (17)
Infiltration rate	0.7168 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.6093 (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	0.7769	0.7616	0.7464	0.6703	0.6550	0.5789	0.5789	0.5636	0.6093	0.6550	0.6855	0.7159 (22b)
Effective ac	0.8018	0.7901	0.7786	0.7246	0.7145	0.6675	0.6675	0.6588	0.6856	0.7145	0.7349	0.7563 (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
Original Windows (Uw = 2.80)			37.6000	2.5180	94.6763		(27)
Solid Door (Old)			2.7600	2.8000	7.7280		(26)
Heatloss Floor 1			53.3000	0.4000	21.3200	110.0000	5863.0000 (28a)
External Wall 1	92.1800	40.3600	51.8200	0.8200	42.4924	190.0000	9845.8000 (29a)
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200 (30)

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Total net area of external elements Aum(A, m2) 199.4600 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 252.5847 (33)
Party Wall 1 163.1600 0.0000 0.0000 70.0000 11421.2000 (32)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27615.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 171.2503 (35)
Thermal bridges (Default value 0.200 * total exposed area) 39.8920 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 292.4767 (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 118.7444 117.0089 115.3078 107.3176 105.8227 98.8636 98.8636 97.5748 101.5441 105.8227 108.8469 112.0086 (38)
411.2210 409.4855 407.7844 399.7943 398.2994 391.3402 391.3402 390.0515 394.0208 398.2994 401.3236 404.4853 (39)
Average = Sum(39)m / 12 = 399.7871
HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
HLP (average) 2.5500 2.5393 2.5287 2.4792 2.4699 2.4268 2.4268 2.4188 2.4434 2.4699 2.4887 2.5083 (40)
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

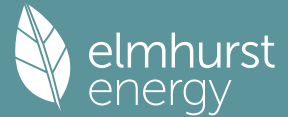
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9507 (42)
Hot water usage for mixer showers 64.4812 63.5122 62.1002 59.3984 57.4046 55.1811 53.9173 55.3187 56.8549 59.2422 62.0020 64.2342 (42a)
Hot water usage for baths 33.4880 32.9906 32.2902 30.9989 30.0320 28.9598 28.3806 29.0761 29.8333 30.9806 32.2985 33.3747 (42b)
Hot water usage for other uses 47.2082 45.4915 43.7749 42.0582 40.3416 38.6249 38.6249 40.3416 42.0582 43.7749 45.4915 47.2082 (42c)
Average daily hot water use (litres/day) 133.4147 (43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Daily hot water use 145.1774 141.9944 138.1653 132.4555 127.7781 122.7658 120.9228 124.7363 128.7464 133.9977 139.7920 144.8171 (44)
Energy conte 229.9255 202.1981 212.3549 181.3250 172.0139 150.9549 146.2457 154.4497 158.7572 181.8336 199.1594 226.7486 (45)
Energy content (annual) Total = Sum(45)m = 2215.9665
Distribution loss (46)m = 0.15 x (45)m 34.4888 30.3297 31.8532 27.1988 25.8021 22.6432 21.9369 23.1674 23.8136 27.2750 29.8739 34.0123 (46)
Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.0900 (48)
Temperature factor from Table 2b 0.7800 (49)
Enter (49) or (54) in (55) 1.6302 (55)
Total storage loss 50.5362 45.6456 50.5362 48.9060 50.5362 48.9060 50.5362 50.5362 48.9060 50.5362 48.9060 50.5362 (56)
If cylinder contains dedicated solar storage 35.3753 31.9519 35.3753 34.2342 35.3753 34.2342 35.3753 35.3753 34.2342 35.3753 34.2342 35.3753 (57)
Primary loss 106.3213 96.0322 106.3213 102.8916 106.3213 36.0948 37.2980 37.2980 36.0948 106.3213 102.8916 106.3213 (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 371.6222 330.1822 354.0516 318.4508 313.7106 221.2839 218.9190 227.1230 229.0862 323.5303 336.2852 368.4453 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Aperture area of solar collector 3.0000 (H1)
Zero-loss collector efficiency 0.8000 (H2)
Collector linear heat loss coefficient 1.8000 (H3)
Collector 2nd order heat loss coefficient 0.0000 (H4)
Collector loop efficiency 0.9000 (H5)
Incidence angle modifier 1.0000 (H6)
Overshading factor 0.8000 (H8)
Overall heat loss coefficient of system 6.5000 (H10)
Heat loss coefficient of collector loop 3.9667 (H11)
Dedicated solar storage volume 75.0000 (H12)
If combined cylinder, total volume of cylinder 250.0000 (H13)
Effective solar volume 127.5000 (H14)
Reference volume 225.0000 (H15)
Storage tank correction coefficient 1.1526 (H16)
Heat delivered to hot water 709.7441 (H24)
Heat delivered to space heating 0.0000 (H29)
Solar input 709.7441
Solar input -0.0000 -21.2657 -66.1036 -91.3464 -121.5042 -107.2913 -107.1297 -93.2482 -64.8377 -35.2267 -1.7905 -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 371.6222 308.9165 287.9479 227.1044 192.2064 113.9926 111.7893 133.8748 164.2485 288.3036 334.4947 368.4453 (64)
Total per year (kWh/year) = Sum(64)m = 2902.9460 (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 161.5073 144.0566 155.6651 142.6039 142.2517 79.0683 78.4651 81.1929 81.6626 145.5167 148.5338 160.4510 (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 65.3442 58.0381 47.1998 35.7333 26.7110 22.5506 24.3667 31.6727 42.5111 53.9776 62.9998 67.1603 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 496.3056 501.4557 488.4776 460.8488 425.9724 393.1935 371.2952 366.1451 379.1232 406.7520 441.6284 474.4073 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 55.6547 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5) -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 -118.0267 (71)
Water heating gains (Table 5) 217.0797 214.3699 209.2272 198.0609 191.1985 109.8171 105.4638 109.1302 113.4203 195.5870 206.2969 215.6599 (72)
Total internal gains 896.3975 891.5318 862.5727 812.3110 761.5500 640.2293 615.7937 621.6161 649.7226 773.9846 828.5932 874.8955 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North				15.4400	10.6334	0.7600	0.7000	0.7700	60.5291 (74)
South				22.1600	46.7521	0.7600	0.7000	0.7700	381.9578 (78)

Solar gains	442.4869	741.2227	993.3965	1216.3233	1363.7892	1358.4654	1307.5280	1194.2250	1068.7184	812.4077	527.4207	380.5067 (83)
Total gains	1338.8844	1632.7544	1855.9691	2028.6344	2125.3392	1998.6946	1923.3218	1815.8411	1718.4410	1586.3924	1356.0139	1255.4023 (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	18.6543	18.7334	18.8116	19.1875	19.2595	19.6020	19.6020	19.6668	19.4687	19.2595	19.1144	18.9650
alpha	2.2436	2.2489	2.2541	2.2792	2.2840	2.3068	2.3068	2.3111	2.2979	2.2840	2.2743	2.2643
util living area	0.9794	0.9670	0.9485	0.9150	0.8571	0.7717	0.6582	0.6938	0.8356	0.9280	0.9694	0.9821 (86)
MIT	17.3285	17.6805	18.2454	19.0043	19.7377	20.3497	20.6918	20.6383	20.1356	19.2096	18.1508	17.2964 (87)
Th 2	18.9918	18.9980	19.0041	19.0330	19.0385	19.0640	19.0640	19.0688	19.0541	19.0385	19.0275	19.0160 (88)
util rest of house	0.9733	0.9574	0.9323	0.8849	0.7969	0.6494	0.4447	0.4929	0.7398	0.8961	0.9586	0.9769 (89)
MIT 2	15.8607	16.2109	16.7695	17.5229	18.2142	18.7606	18.9904	18.9700	18.5955	17.7380	16.6975	15.8424 (90)
Living area fraction	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	fLA = Living area / (4) =	18.3824	17.3338	0.4379 (91)
MIT	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	19.2698	18.3824	17.3338	16.4791 (92)
Temperature adjustment												0.0000
adjusted MIT	16.5034	16.8543	17.4158	18.1715	18.8813	19.4564	19.7354	19.7005	19.2698	18.3824	17.3338	16.4791 (93)

8. Space heating requirement

Utilisation	0.9616	0.9419	0.9138	0.8670	0.7907	0.6798	0.5321	0.5719	0.7535	0.8811	0.9447	0.9664 (94)
Useful gains	1287.5319	1537.9653	1696.0585	1758.7747	1680.4552	1358.7895	1023.4513	1038.4581	1294.9177	1397.7665	1280.9596	1213.2624 (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	5018.3084	4895.1327	4451.2733	3706.7110	2860.3061	1900.5050	1226.9996	1287.3583	2037.0243	3099.7245	4107.0762	4966.6955 (97)
Space heating kWh	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98a)
Space heating requirement - total per year (kWh/year)												15455.5321
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	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15455.5321
Space heating per m2										(98c) / (4) =		95.8423 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	3678.5980	2895.9175	2964.3912	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.5129	0.5878	0.5566	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1886.6656	1702.3418	1649.8548	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	2228.0459	2144.0732	2017.4635	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	245.7938	328.6482	273.5009	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			0.5271 (105)
Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	32.3894	43.3075	36.0405	0.0000	0.0000	0.0000	0.0000 (107)
												111.7375 (107)

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 %)												74.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												3.2000 (209)
Space heating requirement	2775.6977	2256.0165	2049.8798	1402.5141	877.8091	0.0000	0.0000	0.0000	0.0000	1266.2567	2034.8039	2792.5542 (98)
Space heating efficiency (main heating system 1)	74.3000	74.3000	74.3000	74.3000	74.3000	0.0000	0.0000	0.0000	0.0000	74.3000	74.3000	74.3000 (210)
Space heating fuel (main heating system)	3735.7977	3036.3614	2758.9231	1887.6367	1181.4389	0.0000	0.0000	0.0000	0.0000	1704.2486	2738.6325	3758.4848 (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	371.6222	308.9165	287.9479	227.1044	192.2064	113.9926	111.7893	133.8748	164.2485	288.3036	334.4947	368.4453 (64)
Efficiency of water heater												69.2000 (216)

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(217)m	72.9565	72.9301	72.8996	72.7192	72.2741	64.2000	64.2000	64.2000	64.2000	72.2101	72.6990	72.9735	(217)
Fuel for water heating, kWh/month	509.3748	423.5788	394.9925	312.3033	265.9410	177.5585	174.1266	208.5277	255.8387	399.2568	460.1092	504.9030	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	10.1217	13.5336	11.2627	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.0986	12.7342	14.0986	13.6438	14.0986	13.6438	14.0986	14.0986	13.6438	14.0986	13.6438	14.0986	(231)
Lighting	57.1954	45.8842	41.3137	30.2682	23.3800	19.1017	21.3280	27.7230	36.0094	47.2463	53.3646	58.7850	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.7854	-86.6098	-123.7195	-137.8601	-147.2246	-136.8006	-135.2052	-128.5652	-116.1630	-98.7545	-67.7956	-53.4687	(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												20801.5237	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												69.2000	
Water heating fuel used												4086.5109	(219)
Space cooling fuel												34.9180	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												166.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.5993	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1293.9523	(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												24256.5996	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	20801.5237	3.6400	757.1755	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	4086.5109	3.6400	148.7490	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Space cooling	34.9180	16.4900	5.7580	(248)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	461.5993	16.4900	76.1177	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1293.9523	16.4900	-213.3727	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-213.3727	(252)
Total energy cost			893.8008	(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] =	1.5600 (257)
SAP value	74.7122	
SAP rating (Section 12)	75	(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	20801.5237	0.2100	4368.3200	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	4086.5109	0.2100	858.1673	(264)
Space and water heating			5226.4873	(265)
Space cooling	34.9180	0.1139	3.9783	(266)
Pumps, fans and electric keep-hot	166.0000	0.1387	23.0262	(267)
Energy for lighting	461.5993	0.1443	66.6230	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1293.9523	0.1348	-174.3835	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-174.3835	(269)
Total CO2, kg/year			5145.7313	(272)
CO2 emissions per m2			31.9100	(273)
EI value			66.5700	
EI rating			67	(274)
EI band			D	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3000 (1b)	x 2.8500 (2b)	= 151.9050 (1b) - (3b)
First floor	53.9800 (1c)	x 2.7500 (2c)	= 148.4450 (1c) - (3c)
Second floor	53.9800 (1d)	x 2.7500 (2d)	= 148.4450 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	161.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	448.7950 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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 30.0000 / (5) =	0.0668 (8)
Number of storeys in the dwelling (ns)		3 (9)
Additional infiltration	[(9) - 1] x 0.1 =	0.2000 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.3500 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0.0000 (12)
If no draught lobby, enter 0.05, else enter 0		0.0500 (13)
Percentage of windows and doors draught stripped		100.0000 (14)
Window infiltration	0.25 - [0.2 * (14) / 100] =	0.0500 (15)
Pressure test	No Blower Door	
Pressure Test Method		
Measured/design AP50		15.0000 (17)
Infiltration rate		0.7168 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.6093 (21)

Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.6398	0.6093	0.6093	0.5636	0.5636	0.5027	0.5179	0.4875	0.5027	0.5332	0.5332	0.5789 (22b)
Effective ac	0.7047	0.6856	0.6856	0.6588	0.6588	0.6263	0.6341	0.6188	0.6263	0.6421	0.6421	0.6675 (25)

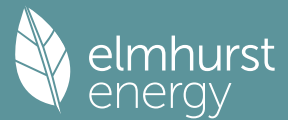
3. Heat losses and heat loss parameter

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						
Original Windows (Uw = 2.80)			37.6000	2.5180	94.6763			(27)					
Solid Door (Old)			2.7600	2.8000	7.7280			(26)					
Heatloss Floor 1			53.3000	0.4000	21.3200	110.0000	5863.0000	(28a)					
External Wall 1	92.1800	40.3600	51.8200	0.8200	42.4924	190.0000	9845.8000	(29a)					
External Roof 1	53.9800		53.9800	1.6000	86.3680	9.0000	485.8200	(30)					
Total net area of external elements Aum(A, m2)			199.4600					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		252.5847			(33)					
Party Wall 1			163.1600	0.0000	0.0000	70.0000	11421.2000	(32)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		27615.8200	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							171.2503	(35)					
Thermal bridges (Default value 0.200 * total exposed area)							39.8920	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss					(33) + (36) + (36a) =		292.4767	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 104.3621	Feb 101.5441	Mar 101.5441	Apr 97.5748	May 97.5748	Jun 92.7636	Jul 93.9148	Aug 91.6467	Sep 92.7636	Oct 95.1005	Nov 95.1005	Dec 98.8636	(38)
Heat transfer coeff	396.8388	394.0208	394.0208	390.0515	390.0515	385.2402	386.3915	384.1233	385.2402	387.5771	387.5771	391.3402	(39)
Average = Sum(39)m / 12 =												389.3727	
HLP	Jan 2.4609	Feb 2.4434	Mar 2.4434	Apr 2.4188	May 2.4188	Jun 2.3889	Jul 2.3961	Aug 2.3820	Sep 2.3889	Oct 2.4034	Nov 2.4034	Dec 2.4268	(40)
HLP (average)												2.4146	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9507 (42)
Hot water usage for mixer showers												
	64.4812	63.5122	62.1002	59.3984	57.4046	55.1811	53.9173	55.3187	56.8549	59.2422	62.0020	64.2342 (42a)
Hot water usage for baths												

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Hot water usage for other uses	33.4880	32.9906	32.2902	30.9989	30.0320	28.9598	28.3806	29.0761	29.8333	30.9806	32.2985	33.3747 (42b)
Average daily hot water use (litres/day)	47.2082	45.4915	43.7749	42.0582	40.3416	38.6249	38.6249	40.3416	42.0582	43.7749	45.4915	47.2082 (42c)
												133.4147 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	145.1774	141.9944	138.1653	132.4555	127.7781	122.7658	120.9228	124.7363	128.7464	133.9977	139.7920	144.8171 (44)
Energy content (annual)	229.9255	202.1981	212.3549	181.3250	172.0139	150.9549	146.2457	154.4497	158.7572	181.8336	199.1594	226.7486 (45)
Distribution loss (46)m = 0.15 x (45)m	34.4888	30.3297	31.8532	27.1988	25.8021	22.6432	21.9369	23.1674	23.8136	27.2750	29.8739	34.0123 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.6302 (55)
Total storage loss	50.5362	45.6456	50.5362	48.9060	50.5362	48.9060	50.5362	50.5362	48.9060	50.5362	48.9060	50.5362 (56)
If cylinder contains dedicated solar storage	35.3753	31.9519	35.3753	34.2342	35.3753	34.2342	35.3753	35.3753	34.2342	35.3753	34.2342	35.3753 (57)
Primary loss	106.3213	96.0322	106.3213	102.8916	106.3213	36.0948	37.2980	37.2980	36.0948	106.3213	102.8916	106.3213 (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	371.6222	330.1822	354.0516	318.4508	313.7106	221.2839	218.9190	227.1230	229.0862	323.5303	336.2852	368.4453 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
If combined cylinder, total volume of cylinder												250.0000 (H13)
Effective solar volume												127.5000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.1526 (H16)
Heat delivered to hot water												776.6919 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												776.6919
Solar input	-3.1323	-22.6026	-67.0572	-96.1033	-123.6188	-117.7087	-116.1164	-104.5684	-73.8604	-42.4846	-9.4393	-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	368.4899	307.5796	286.9944	222.3476	190.0918	103.5752	102.8026	122.5546	155.2258	281.0456	326.8459	368.4453 (64)
												2835.9982 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	161.5073	144.0566	155.6651	142.6039	142.2517	79.0683	78.4651	81.1929	81.6626	145.5167	148.5338	160.4510 (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	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401	177.0401 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.3442	58.0381	47.1998	35.7333	26.7110	22.5506	24.3667	31.6727	42.5111	53.9776	62.9998	67.1603 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	496.3056	501.4557	488.4776	460.8488	425.9724	393.1935	371.2952	366.1451	379.1232	406.7520	441.6284	474.4073 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547	55.6547 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267	-118.0267 (71)
Water heating gains (Table 5)	217.0797	214.3699	209.2272	198.0609	191.1985	109.8171	105.4638	109.1302	113.4203	195.5870	206.2969	215.6599 (72)
Total internal gains	896.3975	891.5318	862.5727	812.3110	761.5500	640.2293	615.7937	621.6161	649.7226	773.9846	828.5932	874.8955 (73)

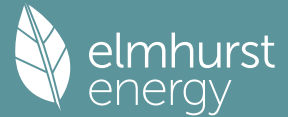
6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
North					15.4400	11.9814	0.7600	0.7000	0.7700		68.2026 (74)	
South					22.1600	50.9848	0.7600	0.7000	0.7700		416.5389 (78)	
Solar gains	484.7415	730.5452	969.7604	1232.5036	1356.0656	1450.2136	1378.8424	1280.2094	1133.6186	855.3747	591.8165	412.9324 (83)
Total gains	1381.1390	1622.0770	1832.3331	2044.8146	2117.6156	2090.4429	1994.6361	1901.8255	1783.3412	1629.3593	1420.4096	1287.8280 (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	19.3304	19.4687	19.4687	19.6668	19.6668	19.9124	19.8531	19.9703	19.9124	19.7923	19.7923	19.6020
alpha	2.2887	2.2979	2.2979	2.3111	2.3111	2.3275	2.3235	2.3314	2.3275	2.3195	2.3195	2.3068
util living area	0.9757	0.9642	0.9424	0.8983	0.8185	0.6704	0.5107	0.5385	0.7737	0.9081	0.9613	0.9789 (86)
MIT	17.6672	17.9652	18.5529	19.3127	20.0611	20.6428	20.8782	20.8602	20.4183	19.5314	18.5067	17.6466 (87)
Th 2	19.0438	19.0541	19.0541	19.0688	19.0688	19.0866	19.0824	19.0908	19.0866	19.0779	19.0779	19.0640 (88)
util rest of house	0.9684	0.9534	0.9235	0.8604	0.7358	0.4909	0.2232	0.2522	0.6363	0.8649	0.9472	0.9725 (89)
MIT 2	16.2256	16.5242	17.1003	17.8390	18.5212	18.9758	19.0745	19.0798	18.8399	18.0672	17.0767	16.2170 (90)

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Living area fraction									fLA = Living area / (4) =		0.4379 (91)	
MIT	16.8568	17.1552	17.7363	18.4843	19.1955	19.7057	19.8643	19.8594	19.5310	18.7083	17.7029	16.8430 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8568	17.1552	17.7363	18.4843	19.1955	19.7057	19.8643	19.8594	19.5310	18.7083	17.7029	16.8430 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9558	0.9379	0.9054	0.8452	0.7426	0.5589	0.3545	0.3827	0.6759	0.8536	0.9323	0.9612	(94)
Useful gains	1320.0679	1521.2716	1659.0749	1728.3219	1572.5338	1168.4160	707.0848	727.8912	1205.3057	1390.7418	1324.2224	1237.8112	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	4665.5700	4552.9784	4072.7186	3348.3101	2416.5604	1427.5951	758.9753	791.0649	1668.4908	2755.0141	3760.6121	4595.5000	(97)
Space heating kWh	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98a)
Space heating requirement - total per year (kWh/year)												13383.7982	
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	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13383.7982	
Space heating per m2										(98c) / (4) =		82.9952	(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.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	3081.9217	2356.9880	2381.5645	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5980	0.6791	0.6578	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1843.1404	1600.6750	1566.6453	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2335.2841	2227.4276	2117.9647	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	354.3434	466.3040	410.1817	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			0.5271	(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	46.6935	61.4471	54.0516	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												162.1922	(107)

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 %)													74.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)													3.2000 (209)
Space heating requirement	2489.0535	2037.3069	1795.7509	1166.3915	627.9558	0.0000	0.0000	0.0000	0.0000	1015.0186	1754.2006	2498.1204	(98)
Space heating efficiency (main heating system 1)	74.3000	74.3000	74.3000	74.3000	74.3000	0.0000	0.0000	0.0000	0.0000	74.3000	74.3000	74.3000	(210)
Space heating fuel (main heating system)	3350.0048	2742.0012	2416.8922	1569.8405	845.1626	0.0000	0.0000	0.0000	0.0000	1366.1085	2360.9698	3362.2079	(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	368.4899	307.5796	286.9944	222.3476	190.0918	103.5752	102.8026	122.5546	155.2258	281.0456	326.8459	368.4453	(64)
Efficiency of water heater (217)m	72.8350	72.8103	72.7366	72.4892	71.6987	64.2000	64.2000	64.2000	64.2000	71.8672	72.5229	69.2000	(216)
Fuel for water heating, kWh/month	505.9239	422.4394	394.5668	306.7320	265.1258	161.3321	160.1287	190.8949	241.7848	391.0624	450.6794	505.8300	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	14.5917	19.2022	16.8911	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.0986	12.7342	14.0986	13.6438	14.0986	13.6438	14.0986	14.0986	13.6438	14.0986	13.6438	14.0986	(231)
Lighting	57.1954	45.8842	41.3137	30.2682	23.3800	19.1017	21.3280	27.7230	36.0094	47.2463	53.3646	58.7850	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-67.3397	-87.1710	-123.6054	-139.8311	-147.4600	-140.5211	-138.3358	-133.0728	-120.7809	-103.3798	-74.8201	-57.9481	(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												18013.1874	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												69.2000	
Water heating fuel used												3996.5002	(219)
Space cooling fuel												50.6851	(221)

Electricity for pumps and fans:

Full SAP Calculation Printout

central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	166.0000 (231)
Electricity for lighting (calculated in Appendix L)	461.5993 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1334.2657 (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	21353.7062 (238)

10a. Fuel costs - using BEDF prices (550)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	18013.1874	5.6000	1008.7385 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3996.5002	5.6000	223.8040 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Space cooling	50.6851	26.0600	13.2085 (248)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	461.5993	26.0600	120.2928 (250)
Additional standing charges			99.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1334.2657	26.0600	-347.7097
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-347.7097 (252)
Total energy cost			1160.5938 (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	18013.1874	0.2100	3782.7694 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3996.5002	0.2100	839.2650 (264)
Space and water heating			4622.0344 (265)
Space cooling	50.6851	0.1139	5.7743 (266)
Pumps, fans and electric keep-hot	166.0000	0.1387	23.0262 (267)
Energy for lighting	461.5993	0.1443	66.6230 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1334.2657	0.1349	-179.9562
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-179.9562 (269)
Total CO2, kg/year			4537.5018 (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	18013.1874	1.1300	20354.9018 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3996.5002	1.1300	4516.0452 (278)
Space and water heating			24870.9470 (279)
Space cooling	50.6851	1.4199	71.9690 (280)
Pumps, fans and electric keep-hot	166.0000	1.5128	251.1248 (281)
Energy for lighting	461.5993	1.5338	708.0165 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1334.2657	1.4985	-1999.3588
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1999.3588 (283)
Total Primary energy kWh/year			23902.6984 (286)