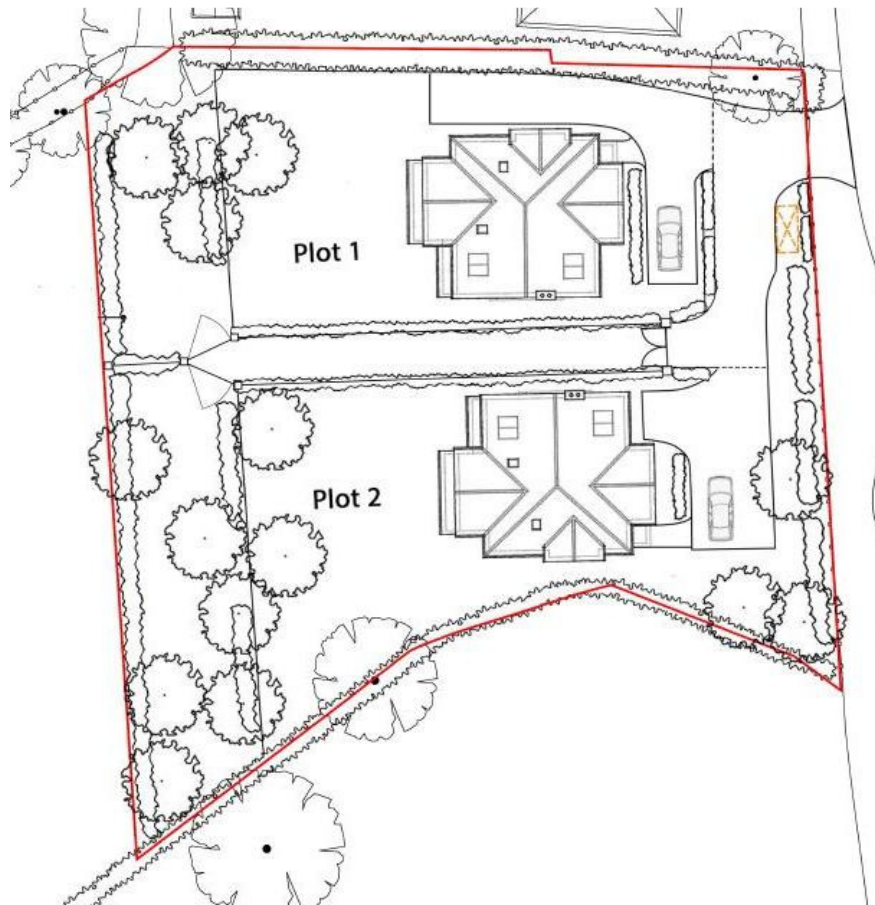


SUSTAINABILITY & ENERGY STATEMENT

Client: Jawbox (Harpenden) LTD
Site Address: Land between Shangri-La & Todds Corner, Todds Green, Stevenage
Local Authority: North Herts Council
Project Details: 2 new dwellings



PREPARED BY: AP CONSULTING ENGINEERS LTD
ELMHURST ACCREDITED ENERGY ASSESSOR 8075-0001/EES017061
BRE CODE FOR SUSTAINABLE HOMES ASSESSOR
AUTHOR: PAUL ALLEN BEng (HONS)
APRIL 2025 REVISION [1]

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1. BACKGROUND

This statement has been prepared on behalf of Jawbox (Harpenden) Limited in support of a residential development comprising 2 new dwelling and associated external works at land between Shangri-La & Todds Corner, Todds Green, Hertfordshire.

2. AIMS & OBJECTIVES

This statement will demonstrate how the proposed development complies with North Hertfordshire Council sustainability policies.

3. EXECUTIVE SUMMARY

The proposed development would achieve a 30% reduction in CO₂ emissions and a 35% reduction in energy demand above the requirements set in Building Regulations part L 2021 by incorporating a high level of thermal fabric performance and renewable heating & energy generation systems.

CO₂ Emissions at each stage of the energy hierarchy:

	Regulated CO ₂ emissions (kg/year/m ²)
Stage 1: 'Be lean' Part L 2021 baseline	2.43
Stage 2: 'Be clean'	2.39
Stage 3: 'Be green'	1.68
% reduction	30%

Energy demand at each stage of the energy hierarchy:

	Energy demand (kWh/year)
Stage 1: 'Be lean' Part L 2021 baseline	4198.9
Stage 2: 'Be clean'	4133.3
Stage 3: 'Be green'	2751.5
% reduction	35%

Energy performance summary:

	% improvement over building regulations 2021
Dwelling emission rate (Tonnes CO ₂ /yr)	76.63
Fabric efficiency (kWh/m ² /yr)	2.97
Primary energy rate (kWh/m ² /yr)	53.18

This statement and associated energy and water calculation checklists demonstrate that the proposed development meets the requirements of the Council's sustainability policy.

4. DEVELOPMENT STRATEGY

The development will follow the well established energy hierarchy





5. 'BE LEAN' (BASELINE) SPECIFICATION

Key design features:	
Wall U-value	0.18W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.10W/m ² k
Window U-value	1.40W/m ² k
Door U-value	1.30W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	None

'BE LEAN' (BASELINE) ENERGY PERFORMANCE

In order to demonstrate compliance with the Councils sustainability policy, government approved software and energy assessors have been used to generate detailed energy calculations based on the planning stage drawings. The process will be repeated prior to construction.

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Sub total kwh/yr
1	1667.9	1363.4	688.8	478.8	4198.9

Note: Energy demand taken from calculated SAP calculation using section 12a and rounded to 2sf



To reduce energy demand for space heating, the external fabric and thermal bridging of the dwellings will be improved as per the table below.

6. 'BE CLEAN' SPECIFICATION

Key design features:	
Wall U-value	0.17W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.10W/m ² k
Window U-value	1.30W/m ² k
Door U-value	1.30W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	None

'BE CLEAN' ENERGY PERFORMANCE

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Sub total kwh/yr
1	1604.9	1362.8	688.8	476.8	4133.3



7. 'BE GREEN' SPECIFICATION

Due to the recent changes in building regulations there are limited practical improvements that can be made to the thermal fabric of the new build dwellings we have therefore concentrated on low and zero carbon heating and cooling technologies (LZC), low energy light and air tightness.

LZC technologies are considered to be renewables the options that will be considered for use are:

- Solar Photovoltaic's
 - Solar thermal hot water
 - Ground source heat pumps
 - Air source heat pumps
 - Biomass boilers
1. Photovoltaic (PV) panels use sunlight to produce electricity; the cells convert the sunlight into electricity which can be used to run plant and lighting.
 2. Solar thermal hot water (SHW) uses solar energy via solar thermal panels for the generation of hot water; solar water heating systems use heat from the sun to warm hot water systems.
 3. Ground source heat pumps (GSHP) circulate a mixture of water and antifreeze around a loop of a pipe which is buried externally. Heat from the ground is absorbed into this fluid and is pumped through a heat exchanger in the heat pump. Low grade heat passes through the heat pump compressor and is concentrated into a higher temperature; this useful heat is capable of providing water for the heating and hot water circuits of the unit. GSHP units generally provide a COP of 4 or greater (4 units of heat per 1 unit of energy (electricity))
 4. Air source heat pumps (ASHP) reclaim the heat available in ambient air and convert it to higher temperatures to heat the unit. As with ground source heat pumps, they use electricity to distribute heat. ASHP systems do not require ground works and are therefore less costly than ground source systems. ASHP systems can be used to both heat and cool retail spaces. ASHP units generally provide a COP of 3 or greater (3 units of heat per 1 unit of energy (electricity))
 5. Biomass fuelled heating systems generally burn wood pellets, chips or logs to power space heating and hot water boilers. Other fuel types are available but the energy density of wood chips or pellets means it is typically the most appropriate. Deliveries of fuel which would result in unacceptable volumes of traffic around the site.

LZC SELECTION

LZC option	Type	Suitability	Justification
1	Solar PV	Yes	Suitable roof area available & low visual impact
2	Solar hot water	No	Hot water demand of residential units is relatively low
3	GSHP	No	Limited space for ground source loops or boreholes
4	ASHP	Yes	Site suitable for heating plant
5	Biomass	No	Limited storage area for biomass fuels.

LZC CONCLUSIONS

Based on the above analysis the most suitable method of achieving the required energy contribution from renewable technologies for this development would be air source heating and solar PV.

'BE GREEN' SPECIFICATION

Key design features:	
Wall U-value	0.17W/m ² k
Floor U-value	0.12W/m ² k
Roof U-value	0.09W/m ² k
Window U-value	1.30W/m ² k
Door U-value	1.30W/m ² k
Air Permeability	4.00 m ³ /hr/m ² at Δ50Pa
Primary heating	Air source heat pump COP >3.5
Ventilation	Natural & trickle ventilation
Thermal bridging	Registered details
Mechanical cooling	None
Renewables	2.00kWp Solar PV & 5kWh battery

'BE GREEN' ENERGY PERFORMANCE

Plot No	Space heating kwh/yr	Water heating kwh/yr	Pumps & fans kwh/yr	Lighting kwh/yr	Contribution from solar PV	Sub total kwh/yr
1	1604.9	1362.8	688.8	476.8	-1381.8	2751.5

8. Sustainability appraisal

Criteria	Requirement	Requirement met?	Justification
Re-use of land	Re-use land and buildings	YES	The site is a former industrial site
Re-use and recycling	Re-use and recycle materials	YES	Aggregates from the demolition of the building will be crushed on site and re-used. Spoil from excavations will be used to landscaping purposes.
Ecological footprint	Use materials and construction techniques that have smaller carbon footprint	YES	All materials used in the development will be sourced from responsible sources. 3 of the 5 categories will achieve an A+ to D rating: For details of the materials please refer to appendix 1.
Green roof and wall systems	Incorporate green external elements	YES	The proposal utilises a sedum based flat roof. <u>The remaining external elements achieve the same U values as a green wall</u>
Building life cycle	Design buildings that can be adapted to suit changing needs of the occupier	YES	Dwellings will be designed to be accessible and adaptable to suit occupants changing needs
Recycling	Provide adequate space for greater levels of waste recycling	YES	Dwellings comply with the guidance set out within the Code for sustainable homes. Provision for the storage of recyclable and non recyclable waste will be provided within the dwelling. Waste storage bins will be stored in a secure covered bin store. Milton Keynes Council operates a collection scheme for both types of waste therefore the mandatory element is deemed to have been met.
Fabric first design	Minimise the energy demand for heating, cooling and lighting	YES	The proposed dwellings achieve the criteria set out in building regulations part L. For details please refer to appendix 2.
Water consumption	Reduce the consumption of potable water	YES	Internal water usage for each dwelling will be limited to 110L/day. This will be

			achieved by specifying the following: - Bath 170L capacity - Shower 10L/s - Dual flush WC 6/3L - Low flow aerated taps (Kitchen 10.00 L/s, Basin 5.00 L/s) - Dishwasher <0.75L per person/cycle - Washing machine <5.00L per kg/cycle - External water butts For details please refer to appendix 3.
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Materials appraisal

Aim:

In order to comply with this part of the “code” 3 of the 5 categories below are required to achieve an A+ to D rating:

- Roof Structure
- External walls
- Upper floor
- Internal walls
- Windows and doors

Results:

The table below demonstrates that the dwellings comply with the requirements.

Element	Summary rating	Climate change	Fossil fuel depletion	Ozone depletion	Freight transport	Human Toxicity	Waste disposal	Water extraction	Acid deposition	Ecotoxicity	Eutrophication	Summer smog	Mineral Extraction	Typical enhancement	Recycled input	Recyclability	Currently recycled	Energy saved by recycling
Roof structure	A	A	A	A	A	A	A	B	A	A	B	A	A	50	B	A	A	A
Wall	A	A	A	A	A	A	B	B	A	A	A	A	A	35	A	A	A	A
Floor	C	A	A	A	A	C	C	C	A	A	B	A	C	60	C	A	A	A
Upper floors	A	A	A	A	C	A	B	B	B	A	A	B	A	60	B	A	A	B
Internal walls	A	A	A	A	A	A	A	A	A	A	A	C	A	60	A	B	B	B
Windows & doors	C	A	A	A	A	A	C	A	C	C	A	A	A	25	A	A	A	A

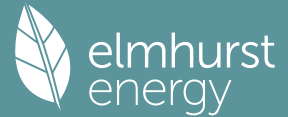
9. WATER CONSUMPTION STRATEGY

Internal water usage for each dwelling will be limited to 110L per person/day. This will be achieved by specifying the following:

Outlet	Target capacity
Toilet	Dual flush 6/3 L
Basin tap	5.00L/min
Kitchen/Utility tap	10.00L/min
Bath	170 L to overflow
Shower	9.00L/min
Washing machine	5.00L per kg dry load
Dishwasher	0.75L per place setting

17. K COMPLIANCE		
EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	107.9
17. K COMPLIANCE?		Yes

Full SAP Calculation Printout



Property Reference	LEAN				Issued on Date	01/04/2025
Assessment Reference	PLOT 1		Prop Type Ref			
Property	Land between, Shangri-La & Todds Corner, Todds Green, Stevenage, Hertfordshire, SG1 2JE					
SAP Rating	87 B	DER	2.43	TER	7.19	
Environmental	97 A	% DER < TER				66.20
CO ₂ Emissions (t/year)	0.59	DFEE	33.46	TFEE	33.66	
Compliance Check	See BREL	% DFEE < TFEE				0.60
% DPER < TPER	32.22	DPER	25.55	TPER	37.70	
Assessor Details	Mr. Paul Allen				Assessor ID	8075-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

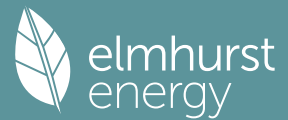
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.3258	34.2841		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.0197		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.0464 (35)

Full SAP Calculation Printout



List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	105.5346 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014	(38)
Heat transfer coeff	174.4309	173.4072	172.3835	167.2649	166.2412	161.1226	161.1226	160.0989	163.1700	166.2412	168.2886	170.3360	(39)
Average = Sum(39)m / 12 =												167.0090	
HLP	0.6883	0.6842	0.6802	0.6600	0.6559	0.6357	0.6357	0.6317	0.6438	0.6559	0.6640	0.6721	(40)
HLP (average)												0.6590	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)												122.8872	(43)
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7195	
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume												200.0000	(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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2629.9755	(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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(65)

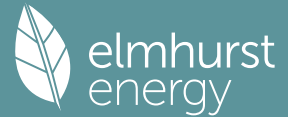
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	879.9098	907.7958	866.0566	840.6850	796.8563	770.7495	740.2254	739.2428	762.2488	784.7169	832.0178	860.1263	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.8800	10.6334	0.6300	0.7000	0.7700	9.3591 (74)
East	10.9200	19.6403	0.6300	0.7000	0.7700	65.5453 (76)
West	12.0600	19.6403	0.6300	0.7000	0.7700	72.3880 (80)

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Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	1027.2022	1195.5084	1340.8153	1537.5848	1656.8670	1654.2046	1580.0144	1456.2966	1315.6067	1126.1799	1015.5502	981.3582 (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	39.1677	39.3990	39.6330	40.8458	41.0973	42.4029	42.4029	42.6741	41.8708	41.0973	40.5973	40.1093
alpha	3.6112	3.6266	3.6422	3.7231	3.7398	3.8269	3.8269	3.8449	3.7914	3.7398	3.7065	3.6740
util living area	0.9849	0.9731	0.9492	0.8812	0.7609	0.5805	0.4369	0.4868	0.7257	0.9192	0.9738	0.9870 (86)
Living	19.5192	19.7178	20.0119	20.4202	20.7052	20.8662	20.9054	20.8991	20.7907	20.4014	19.9156	19.5172
Non living	18.5558	18.8111	19.1865	19.7094	20.0534	20.2475	20.2848	20.2836	20.1648	19.6956	19.0779	18.5638
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2425	19.7178	20.0119	20.4202	20.7052	20.8662	20.9054	20.8991	20.7907	20.4014	19.9156	19.7246 (87)
Th 2	20.3512	20.3548	20.3584	20.3763	20.3799	20.3979	20.3979	20.4016	20.3907	20.3799	20.3727	20.3655 (88)
util rest of house	0.9829	0.9696	0.9425	0.8659	0.7314	0.5353	0.3809	0.4292	0.6840	0.9056	0.9699	0.9853 (89)
MIT 2	19.6354	18.8111	19.1865	19.7094	20.0534	20.2475	20.2848	20.2836	20.1648	19.6956	19.0779	18.8885 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	19.6860	18.8866	19.2553	19.7686	20.1078	20.2991	20.3365	20.3349	20.2170	19.7544	19.1477	18.9582 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6860	18.8866	19.2553	19.7686	20.1078	20.2991	20.3365	20.3349	20.2170	19.7544	19.1477	18.9582 (93)

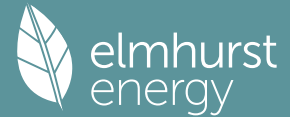
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9805	0.9595	0.9284	0.8488	0.7174	0.5275	0.3751	0.4226	0.6711	0.8891	0.9600	0.9805 (94)
Useful gains	1007.1975	1147.0669	1244.8035	1305.0689	1188.6151	872.6397	592.6678	615.4641	882.9043	1001.2319	974.8962	962.2413 (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	2683.7987	2425.3856	2198.8003	1817.9348	1397.7146	918.2527	602.0400	629.9680	998.1096	1521.8341	2027.4915	2513.8452 (97)
Space heating kWh	1247.3913	859.0302	709.7737	369.2634	155.5700	0.0000	0.0000	0.0000	0.0000	387.3280	757.8686	1154.3933 (98a)
Space heating requirement - total per year (kWh/year)	5640.6185											
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	1247.3913	859.0302	709.7737	369.2634	155.5700	0.0000	0.0000	0.0000	0.0000	387.3280	757.8686	1154.3933 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	5640.6185											
Space heating per m2	(98c) / (4) = 22.2562 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	338.1787 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1247.3913	859.0302	709.7737	369.2634	155.5700	0.0000	0.0000	0.0000	0.0000	387.3280	757.8686	1154.3933 (98)
Space heating efficiency (main heating system 1)	338.1787	338.1787	338.1787	338.1787	338.1787	0.0000	0.0000	0.0000	0.0000	338.1787	338.1787	338.1787 (210)
Space heating fuel (main heating system)	368.8557	254.0167	209.8813	109.1918	46.0023	0.0000	0.0000	0.0000	0.0000	114.5335	224.1030	341.3560 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Water heating requirement	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047 (216)
Efficiency of water heater	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047 (217)
Fuel for water heating, kWh/month	135.4983	119.7411	127.1018	111.6271	108.0960	97.2940	95.9977	99.9058	101.0976	112.8534	120.1287	134.0137 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Pumps and Fa	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Lighting	Electricity generated by PVs (Appendix M) (negative quantity)											
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 (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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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)	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)
(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											
Space heating fuel - main system 1	1667.9403 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	192.9047											

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Water heating fuel used	1363.3551 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100) mechanical ventilation fans (SFP = 0.9100)	688.8080 (230a)
Total electricity for the above, kWh/year	688.8080 (231)
Electricity for lighting (calculated in Appendix L)	476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4196.9223 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1667.9403	0.1557	259.6219	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1363.3551	0.1409	192.1088	(264)
Space and water heating			451.7307	(265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462	(267)
Energy for lighting	476.8188	0.1443	68.8197	(268)
Total CO2, kg/year			616.0965	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.4300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1667.9403	1.5762	2629.0641	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1363.3551	1.5210	2073.7043	(278)
Space and water heating			4702.7685	(279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288	(281)
Energy for lighting	476.8188	1.5338	731.3605	(282)
Total Primary energy kWh/year			6476.1578	(286)
Dwelling Primary energy Rate (DPER)			25.5500	(287)

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

1. Overall dwelling characteristics

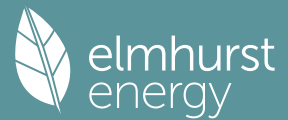
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280	(1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080	(1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0645 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3145	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695	(22b)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			4.0600	1.0000	4.0600		(26)
TER Opening Type			25.8600	1.1450	29.6107		(27)
Heatloss Floor 1			96.7200	0.1300	12.5736		(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344		(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392		(30)
Total net area of external elements Aum(A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					88.2179		(33)

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

97.0464 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	24.1300	0.0500	1.2065
E3 Sill	23.1300	0.0500	1.1565
E4 Jamb	41.4000	0.0500	2.0700
E5 Ground floor (normal)	40.4000	0.1600	6.4640
E10 Eaves (insulation at ceiling level)	24.8000	0.0600	1.4880
E12 Gable (insulation at ceiling level)	15.6000	0.0600	0.9360
E16 Corner (normal)	14.7600	0.0900	1.3284
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428
E6 Intermediate floor within a dwelling	40.4000	0.0000	0.0000

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

14.2066 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 102.4245 (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	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490
Average = Sum(39)m / 12 =	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for other uses	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Average daily hot water use (litres/day)	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
													122.8872 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708

Water storage loss:

Store volume

200.0000 (47)

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

1.6525 (48)

Temperature factor from Table 2b

0.5400 (49)

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

0.8924 (55)

Total storage loss

27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 (56)

If cylinder contains dedicated solar storage

27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month

262.2622 231.7806 246.0650 216.1852 209.4019 188.5360 186.0637 193.6025 195.8732 218.5792 232.5851 259.3983 (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 0.0000 (63a)

FV 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 -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 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 0.0000 (63d)

Output from w/h

262.2622 231.7806 246.0650 216.1852 209.4019 188.5360 186.0637 193.6025 195.8732 218.5792 232.5851 259.3983 (64)

12Total per year (kWh/year)

Total per year (kWh/year) = Sum(64a)m = 2640.3329 (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) = Sum(64a)m = 0.0000 (64a)

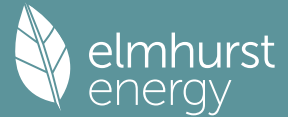
Heat gains from water heating, kWh/month

111.0101 98.5710 105.6246 94.9215 93.4341 85.7282 85.6741 88.1808 88.1678 96.4855 100.3745 110.0579 (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	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570
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
Losses e.g. evaporation (negative values) (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561
Water heating gains (Table 5)												

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Total internal gains	149.2072	146.6831	141.9685	131.8354	125.5834	119.0669	115.1534	118.5225	122.4553	129.6848	139.4090	147.9272 (72)
	883.8556	911.7417	870.0025	844.6309	800.8022	771.6953	741.1713	740.1887	763.1946	788.6628	835.9637	864.0722 (73)

6. Solar gains

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

North					2.8800	10.6334	0.6300	0.7000			0.7700	9.3591 (74)	
East					10.9200	19.6403	0.6300	0.7000			0.7700	65.5453 (76)	
West					12.0600	19.6403	0.6300	0.7000			0.7700	72.3880 (80)	

Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)	
Total gains	1031.1481	1199.4543	1344.7612	1541.5306	1660.8129	1655.1505	1580.9603	1457.2425	1316.5525	1130.1258	1019.4960	985.3041 (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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area	0.9854	0.9759	0.9580	0.9107	0.8236	0.6818	0.5415	0.5945	0.8003	0.9377	0.9768	0.9873 (86)
MIT	18.5679	18.8359	19.2702	19.8829	20.4096	20.7791	20.9218	20.8938	20.6063	19.9099	19.1476	18.5369 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house	0.9833	0.9725	0.9517	0.8965	0.7939	0.6263	0.4611	0.5153	0.7564	0.9251	0.9729	0.9855 (89)
MIT 2	17.2758	17.6186	18.1720	18.9482	19.5926	20.0212	20.1628	20.1416	19.8381	18.9927	18.0244	17.2412 (90)
Living area fraction	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	0.0833 (91)
MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (93)

8. Space heating requirement

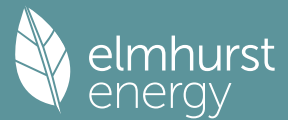
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9722	0.9571	0.9308	0.8702	0.7701	0.6162	0.4622	0.5139	0.7363	0.9010	0.9579	0.9755 (94)
Useful gains	1002.4700	1148.0306	1251.7250	1341.3764	1279.0599	1019.8347	730.7806	748.8851	969.3861	1018.2201	976.5958	961.1563 (95)
Ext temp.	4.3000	4.9000	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	2894.7741	2828.2992	2587.8381	2197.8247	1723.4597	1173.2879	775.7363	812.0522	1246.9881	1833.5383	2397.6149	2876.6834 (97)
Space heating kWh	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98a)
Space heating requirement - total per year (kWh/year)												7533.2417
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	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7533.2417
Space heating per m2										(98c) / (4) =		29.7240 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1525.3242	1223.3375	1076.9969	668.0854	358.2161	0.0000	0.0000	0.0000	0.0000	657.2012	1108.4872	1544.0435 (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	262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983 (64)
Efficiency of water heater	87.2547	87.1265	86.8563	86.2742	85.0793	79.8000	79.8000	79.8000	79.8000	86.2241	86.9830	79.8000 (216)
Fuel for water heating, kWh/month	300.5709	266.0278	283.3012	250.5791	246.1255	236.2606	233.1625	242.6097	245.4551	253.5013	267.3916	87.2841 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	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	50.5346	40.5408	36.5025	26.7433	20.6573	16.8772	18.8443	24.4945	31.8159	41.7442	47.1500	51.9391 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-84.4391	-116.0247	-162.4452	-177.5451	-186.9889	-172.6716	-170.3033	-162.8427	-149.1869	-130.0603	-91.6615	-73.3413 (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)

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

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

Air changes per hour
40.0000 / (5) = 0.0645 (8)
Yes
Blower Door
4.0000 (17)
0.2645 (18)
0 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
(21) = (18) x (20) = 0.2645 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.3372	0.3306	0.3240	0.2909	0.2843	0.2512	0.2512	0.2446	0.2645	0.2843	0.2975	0.3108	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5569	0.5546	0.5525	0.5423	0.5404	0.5316	0.5316	0.5299	0.5350	0.5404	0.5443	0.5483	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.3258	34.2841			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)					92.0197			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
97.0464 (35)

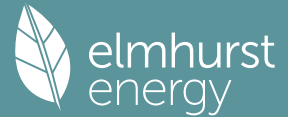
List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	24.1300	0.2200	5.3086	
E2 Other lintels (including other steel lintels)	23.1300	0.0120	0.2776	
E3 Sill	41.4000	0.0100	0.4140	
E4 Jamb	40.4000	0.0650	2.6260	
E5 Ground floor (normal)	24.8000	0.0360	0.8928	
E10 Eaves (insulation at ceiling level)	15.6000	0.0550	0.8580	
E12 Gable (insulation at ceiling level)	14.7600	0.0540	0.7970	
E16 Corner (normal)	4.9200	-0.0990	-0.4871	
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0700	2.8280	
E6 Intermediate floor within a dwelling				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss			105.5346	(37)
				(33) + (36) + (36a) =

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	114.0120	113.5600	113.1170	111.0360	110.6467	108.8342	108.8342	108.4985	109.5323	110.6467	111.4343	112.2577	(38)
Average = Sum(39)m / 12 =	219.5467	219.0947	218.6516	216.5706	216.1813	214.3688	214.3688	214.0332	215.0669	216.1813	216.9689	217.7924	(39)
												216.5688	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8663	0.8645	0.8627	0.8545	0.8530	0.8458	0.8458	0.8445	0.8486	0.8530	0.8561	0.8593	(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													3.0714	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	32.6841	32.1987	31.5151	30.2548	29.3111	28.2646	27.6994	28.3781	29.1172	30.2369	31.5232	32.5736	32.5736	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	46.0842	(42c)
Average daily hot water use (litres/day)													72.1981	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317	78.6578	78.6578	(44)
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786	123.1591	123.1591	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853	104.6853	(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	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	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	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	0.0000	(63d)
Output from w/h	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853	104.6853	(64)
12Total per year (kWh/year)													1019.1973	(64)
Electric shower(s)													1019	(64)

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	60.6369	54.0279	58.9964	56.2996	57.3560	54.7121	56.5358	57.3560	56.2996	58.9964	57.8871	60.6369 (64a)
	Total Energy used by instantaneous electric shower (s) (kWh/year) = Sum(64a)m =											689.7407 (64a)
Heat gains from water heating, kWh/month	41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597	41.3305 (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
	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518 (72)
Total internal gains	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					2.8800	10.6334	0.6300	0.7000	0.7700	9.3591 (74)		
East					10.9200	19.6403	0.6300	0.7000	0.7700	65.5453 (76)		
West					12.0600	19.6403	0.6300	0.7000	0.7700	72.3880 (80)		
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	934.9470	1104.3666	1252.2104	1455.0557	1577.9143	1579.0218	1507.3969	1381.9562	1239.1846	1045.5466	929.1144	889.9286 (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	31.1190	31.1832	31.2464	31.5466	31.6034	31.8706	31.8706	31.9206	31.7672	31.6034	31.4887	31.3696
alpha	3.0746	3.0789	3.0831	3.1031	3.1069	3.1247	3.1247	3.1280	3.1178	3.1069	3.0992	3.0913
util living area	0.9888	0.9806	0.9647	0.9213	0.8392	0.7020	0.5625	0.6183	0.8205	0.9482	0.9819	0.9904 (86)
MIT	18.5041	18.7733	19.2112	19.8295	20.3720	20.7582	20.9125	20.8805	20.5718	19.8499	19.0775	18.4648 (87)
Th 2	20.1963	20.1978	20.1993	20.2063	20.2076	20.2138	20.2138	20.2149	20.2114	20.2076	20.2050	20.2022 (88)
util rest of house	0.9872	0.9778	0.9593	0.9085	0.8110	0.6470	0.4806	0.5382	0.7790	0.9374	0.9788	0.9890 (89)
MIT 2	17.8596	18.1283	18.5639	19.1760	19.6957	20.0470	20.1677	20.1482	19.8914	19.2039	18.4375	17.8245 (90)
Living area fraction	17.9133	18.1821	18.6178	19.2304	19.7521	20.1062	20.2297	20.2092	19.9481	19.2578	18.4908	17.8778 (91)
MIT	17.9133	18.1821	18.6178	19.2304	19.7521	20.1062	20.2297	20.2092	19.9481	19.2578	18.4908	17.8778 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9133	18.1821	18.6178	19.2304	19.7521	20.1062	20.2297	20.2092	19.9481	19.2578	18.4908	17.8778 (93)

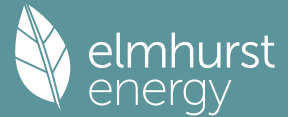
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9805	0.9680	0.9451	0.8890	0.7923	0.6387	0.4823	0.5376	0.7627	0.9204	0.9694	0.9831 (94)
Useful gains	916.7530	1068.9885	1183.4849	1293.5333	1250.1487	1008.5919	727.0868	742.9441	945.1877	962.3402	900.6419	874.9208 (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	2988.7500	2910.0351	2649.5785	2237.2660	1740.7069	1180.3653	778.1001	815.2957	1257.7409	1871.6463	2471.4481	2978.9255 (97)
Space heating kWh	1541.5658	1237.1833	1090.7736	679.4875	364.9753	0.0000	0.0000	0.0000	0.0000	676.5238	1130.9805	1565.3795 (98a)
Space heating requirement - total per year (kWh/year)												8286.8692
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	1541.5658	1237.1833	1090.7736	679.4875	364.9753	0.0000	0.0000	0.0000	0.0000	676.5238	1130.9805	1565.3795 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8286.8692
Space heating per m2										(98c) / (4) =		32.6976 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	2015.0667	1586.3291	1626.6520	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6924	0.7683	0.7238	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1395.2154	1218.7413	1177.3617	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	227.1017	307.7207	233.2972	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.7754	76.9302	58.3243	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												192.0299 (107)

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Energy for space heating 32.6976 (99)
Energy for space cooling 0.7577 (108)
Total 33.4553 (109)
Fabric Energy Efficiency (DFEE) 33.5 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0645 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3145	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Opaque door			4.0600	1.0000	4.0600		(26)
TER Opening Type			25.8600	1.1450	29.6107		(27)
Heatloss Floor 1			96.7200	0.1300	12.5736		(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344		(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392		(30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	88.2179	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 97.0464 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	24.1300	0.0500	1.2065
E2 Other lintels (including other steel lintels)	23.1300	0.0500	1.1565
E3 Sill	41.4000	0.0500	2.0700
E4 Jamb	40.4000	0.1600	6.4640
E5 Ground floor (normal)	24.8000	0.0600	1.4880
E10 Eaves (insulation at ceiling level)	15.6000	0.0600	0.9360
E12 Gable (insulation at ceiling level)	14.7600	0.0900	1.3284
E16 Corner (normal)	4.9200	-0.0900	-0.4428
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0000	0.0000
E6 Intermediate floor within a dwelling			

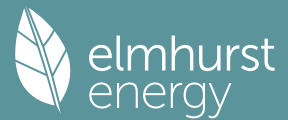
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.2066 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 102.4245 (37)

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	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490 (38)
Heat transfer coeff	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735 (39)
Average = Sum(39)m / 12 =												217.0435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632 (40)
HLP (average)												0.8564
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0714 (42)										
Hot water usage for mixer showers	0.0000 (42a)										
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hot water usage for other uses	32.6841	32.1987	31.5151	30.2548	29.3111	28.2646	27.6994	28.3781	29.1172	30.2369	31.5232
Average daily hot water use (litres/day)	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084
Daily hot water use	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:	0.0000 (46)										
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518
WWHRS	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
Solar input	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
Output from w/h	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1019.1973 (64)										
Electric shower(s)	60.6369	54.0279	58.9964	56.2996	57.3560	54.7121	56.5358	57.3560	56.2996	58.9964	57.8871
Heat gains from water heating, kWh/month	41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597

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	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561
Water heating gains (Table 5)	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518
Total internal gains	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968

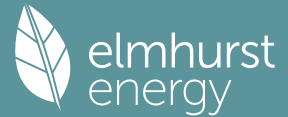
6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.8800	10.6334		0.6300		0.7000		0.7700		9.3591 (74)
East				10.9200	19.6403		0.6300		0.7000		0.7700		65.5453 (76)
West				12.0600	19.6403		0.6300		0.7000		0.7700		72.3880 (80)
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319	(83)
Total gains	934.9470	1104.3666	1252.2104	1455.0557	1577.9143	1579.0218	1507.3969	1381.9562	1239.1846	1045.5466	929.1144	889.9286	(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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area	0.9888	0.9806	0.9648	0.9215	0.8394	0.7014	0.5617	0.6174	0.8204	0.9482	0.9819	0.9904 (86)
MIT	18.4847	18.7563	19.1973	19.8253	20.3700	20.7597	20.9132	20.8817	20.5725	19.8475	19.0713	18.4536 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house	0.9872	0.9778	0.9594	0.9087	0.8113	0.6464	0.4800	0.5375	0.7788	0.9375	0.9788	0.9890 (89)
MIT 2	17.8365	18.1080	18.5471	19.1707	19.6930	20.0495	20.1695	20.1508	19.8924	19.2009	18.4298	17.8111 (90)
Living area fraction	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (91)
MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9805	0.9680	0.9452	0.8891	0.7925	0.6383	0.4818	0.5369	0.7626	0.9205	0.9693	0.9831	(94)
Useful gains	916.7032	1068.9724	1183.5741	1293.7186	1250.4727	1007.8247	726.2985	742.0000	945.0545	962.3842	900.6338	874.8918	(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													
Space heating kWh	3006.9495	2925.7977	2662.1454	2241.0627	1742.6687	1178.4865	776.8917	813.6326	1257.0920	1873.7162	2477.1072	2989.4627	(97)
Space heating requirement - total per year (kWh/year)	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98a)
Solar heating kWh												8337.6011	
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	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8337.6011	
Space heating per m2												32.8977	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6935	0.7693	0.7252	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1394.5270	1217.8658	1176.4606	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh													
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	227.5973	308.3721	233.9676	0.0000	0.0000	0.0000	0.0000	(103)
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	(104)
Space cooling kWh													
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	56.8993	77.0930	58.4919	0.0000	0.0000	0.0000	0.0000	(105)
Energy for space heating													
Energy for space cooling													
Total													
Fabric Energy Efficiency (TFEE)													

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

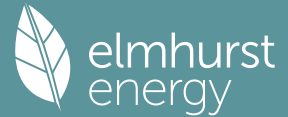
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)
Adj infilt rate	0.2550 0.2500 0.2450 0.2200 0.2150 0.1900 0.1900 0.1850 0.2000 0.2150 0.2250 0.2350 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	83.7000 (23c)
Effective ac	0.3365 0.3315 0.3265 0.3015 0.2965 0.2715 0.2715 0.2665 0.2815 0.2965 0.3065 0.3165 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.3258	34.2841		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum (A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		92.0197		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.0464 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5149 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 105.5346 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014 (38)
Average = Sum(39)m / 12 =	174.4309	173.4072	172.3835	167.2649	166.2412	161.1226	161.1226	160.0989	163.1700	166.2412	168.2886	170.3360 (39)
HLP	0.6883	0.6842	0.6802	0.6600	0.6559	0.6357	0.6357	0.6317	0.6438	0.6559	0.6640	0.6721 (40)
HLP (average)												0.6590
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

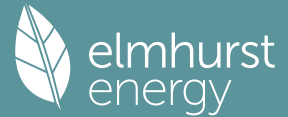
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths													(42b)
Hot water usage for other uses													(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use													(44)
Energy conte													(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													(46)
Water storage loss:													(47)
Store volume													(48)
a) If manufacturer declared loss factor is known (kWh/day):													(49)
Temperature factor from Table 2b													(50)
Enter (49) or (54) in (55)													(51)
Total storage loss													(52)
If cylinder contains dedicated solar storage													(53)
Primary loss													(54)
Combi loss													(55)
Total heat required for water heating calculated for each month													(56)
WWHRS													(57)
PV diverter													(58)
Solar input													(59)
FGHRS													(60)
Output from w/h													(61)
Electric shower(s)													(62)
Heat gains from water heating, kWh/month													(63)

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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
Pumps, fans												

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Losses e.g. evaporation (negative values) (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					2.8800	10.6334	0.6300		0.7000		0.7700		9.3591 (74)	
East					10.9200	19.6403	0.6300		0.7000		0.7700		65.5453 (76)	
West					12.0600	19.6403	0.6300		0.7000		0.7700		72.3880 (80)	
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)		
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (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	39.1677	39.3990	39.6330	40.8458	41.0973	42.4029	42.4029	42.6741	41.8708	41.0973	40.5973	40.1093		
alpha	3.6112	3.6266	3.6422	3.7231	3.7398	3.8269	3.8269	3.8449	3.7914	3.7398	3.7065	3.6740		
util living area	0.9809	0.9697	0.9430	0.8764	0.7582	0.5849	0.4407	0.4896	0.7260	0.9135	0.9700	0.9838	(86)	
Living	19.5736	19.7492	20.0458	20.4319	20.7079	20.8648	20.9050	20.8987	20.7905	20.4174	19.9461	19.5675		
Non living	18.6250	18.8509	19.2288	19.7233	20.0564	20.2463	20.2845	20.2833	20.1647	19.7149	19.1164	18.6278		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10		
MIT	20.2703	19.7492	20.0458	20.4319	20.7079	20.8648	20.9050	20.8987	20.7905	20.4174	19.9461	19.7679	(87)	
Th 2	20.3512	20.3548	20.3584	20.3763	20.3799	20.3979	20.3979	20.4016	20.3907	20.3799	20.3727	20.3655	(88)	
util rest of house	0.9785	0.9659	0.9357	0.8607	0.7286	0.5395	0.3843	0.4318	0.6843	0.8991	0.9656	0.9817	(89)	
MIT 2	19.6630	18.8509	19.2288	19.7233	20.0564	20.2463	20.2845	20.2833	20.1647	19.7149	19.1164	18.9410	(90)	
Living area fraction									FLA = Living area / (4) =			0.0833	(91)	
MIT	19.7136	18.9257	19.2969	19.7824	20.1107	20.2978	20.3362	20.3346	20.2168	19.7735	19.1856	19.0099	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.7136	18.9257	19.2969	19.7824	20.1107	20.2978	20.3362	20.3346	20.2168	19.7735	19.1856	19.0099	(93)	

8. Space heating requirement

Utilisation	0.9757	0.9551	0.9209	0.8436	0.7147	0.5317	0.3784	0.4251	0.6714	0.8823	0.9549	0.9760	(94)	
Useful gains	1080.0332	1187.8473	1287.8343	1319.2778	1191.7325	871.2206	592.3332	615.1234	882.7278	1020.7416	1014.0682	1028.5523	(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	2688.6149	2432.1608	2205.9748	1820.2367	1398.1999	918.0453	601.9907	629.9180	998.0826	1525.0065	2033.8612	2522.6565	(97)	
Space heating kWh	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135	(98a)	
Space heating requirement - total per year (kWh/year)												5451.3997		
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	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5451.3997		
Space heating per m ²										(98c) / (4) =		21.5096	(99)	

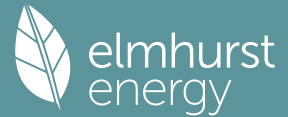
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													338.1787	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135	(98)	
Space heating efficiency (main heating system 1)	338.1787	338.1787	338.1787	338.1787	338.1787	0.0000	0.0000	0.0000	0.0000	338.1787	338.1787	338.1787	(210)	
Space heating fuel (main heating system)	353.8913	247.2594	201.9928	106.6568	45.4233	0.0000	0.0000	0.0000	0.0000	110.9393	217.1192	328.7060	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)	
Efficiency of water heater (217)m	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	(216)	
Fuel for water heating, kWh/month	135.4983	119.7411	127.1018	111.6271	108.0960	97.2940	95.9977	99.9058	101.0976	112.8534	120.1287	134.0137	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015	(231)	
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232	(232)	

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		Area (m ²)		Storey height (m)		Volume (m ³)
Main dwelling						
Ground floor		96.7200 (1b)	x	2.4000 (2b)	=	232.1280 (1b) - (3b)
First floor		96.7200 (1c)	x	2.6500 (2c)	=	256.3080 (1c) - (3c)
Second floor		60.0000 (1d)	x	2.2000 (2d)	=	132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	253.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	=	620.4360 (5)

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2000 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Adj infilt rate	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (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	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)

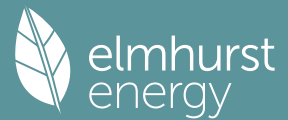
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Main dwelling												
WINDOW			25.8600	1.3258	34.2841			(27)				
DOOR			4.0600	1.5000	6.0900			(26)				
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)				
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000	(29a)				
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)				
Total net area of external elements Aum(A, m2)			397.4400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.0197			(33)				
Main dwelling												
Internal Wall 1			100.0000			9.0000	900.0000	(32c)				
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)				
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24595.4400	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086						
E3 Sill				23.1300	0.0120	0.2776						
E4 Jamb				41.4000	0.0100	0.4140						
E5 Ground floor (normal)				40.4000	0.0650	2.6260						
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928						
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580						
E16 Corner (normal)				14.7600	0.0540	0.7970						
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871						
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149	(36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	105.5346 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.7777	Feb 62.7540	Mar 62.7540	Apr 57.6354	May 56.6117	Jun 52.5168	Jul 52.5168	Aug 52.5168	Sep 54.5642	Oct 57.6354	Nov 57.6354	Dec 59.6828 (38)
Heat transfer coeff	169.3123	168.2886	168.2886	163.1700	162.1463	158.0514	158.0514	158.0514	160.0989	163.1700	163.1700	165.2175 (39)
Average = Sum(39)m / 12 =												163.0847
HLP	Jan 0.6681	Feb 0.6640	Mar 0.6640	Apr 0.6438	May 0.6398	Jun 0.6236	Jul 0.6236	Aug 0.6236	Sep 0.6317	Oct 0.6438	Nov 0.6438	Dec 0.6519 (40)
HLP (average)												0.6435
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	87.0603 (42b)
Hot water usage for other uses	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	46.0842 (42c)
Average daily hot water use (litres/day)	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)

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Water storage loss:											
Store volume											200.0000 (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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month											
261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h											
261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Total per year (kWh/year) = Sum(64)m =											2629.9755 (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											
110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541 (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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)												
	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)												
	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814 (72)
Total internal gains												
	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853 (73)

6. Solar gains

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

North					2.8800	12.0246	0.6300	0.7000			0.7700			10.5837 (74)
East					10.9200	22.3829	0.6300	0.7000			0.7700			74.6984 (76)
West					12.0600	22.3829	0.6300	0.7000			0.7700			82.4966 (80)

Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145	775.9702	605.8185	373.5601	208.7025	136.7391 (83)		
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810	1505.9578	1367.3018	1188.9618	1087.1327	1069.3244 (84)		

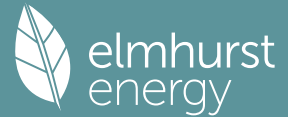
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3519	40.5973	40.5973	41.8708	42.1352	43.2269	43.2269	43.2269	42.6741	41.8708	41.8708	41.3520
alpha	3.6901	3.7065	3.7065	3.7914	3.8090	3.8818	3.8818	3.8818	3.8449	3.7914	3.7914	3.7568
util living area												
	0.9791	0.9681	0.9375	0.8584	0.7217	0.5119	0.3559	0.3920	0.6671	0.8953	0.9655	0.9824 (86)
Living												
	19.6531	19.8095	20.1150	20.5031	20.7611	20.8907	20.9151	20.9127	20.8352	20.4944	20.0318	19.6444
Non living												
	18.7394	18.9408	19.3268	19.8218	20.1299	20.2820	20.3036	20.3020	20.2218	19.8179	19.2385	18.7392
24 / 16												
	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9												
	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9												
	28	0	0	0	0	0	0	0	0	0	0	10
MIT												
	20.3110	19.8095	20.1150	20.5031	20.7611	20.8907	20.9151	20.9127	20.8352	20.4944	20.0318	19.8340 (87)
Th 2												
	20.3691	20.3727	20.3727	20.3907	20.3943	20.4088	20.4088	20.4088	20.4016	20.3907	20.3907	20.3835 (88)
util rest of house												
	0.9765	0.9641	0.9295	0.8410	0.6895	0.4655	0.3007	0.3335	0.6211	0.8783	0.9605	0.9802 (89)
MIT 2												
	19.7194	18.9408	19.3268	19.8218	20.1299	20.2820	20.3036	20.3020	20.2218	19.8179	19.2385	19.0355 (90)
Living area fraction												
	19.7687	19.0132	19.3925	19.8786	20.1825	20.3328	20.3545	20.3529	20.2729	19.8743	19.3046	0.0833 (91)
Temperature adjustment												
	19.7687	19.0132	19.3925	19.8786	20.1825	20.3328	20.3545	20.3529	20.2729	19.8743	19.3046	0.0000 (92)
adjusted MIT												
	19.7687	19.0132	19.3925	19.8786	20.1825	20.3328	20.3545	20.3529	20.2729	19.8743	19.3046	19.1020 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9736	0.9532	0.9145	0.8246	0.6774	0.4593	0.2955	0.3279	0.6106	0.8613	0.9492	0.9743 (94)
Useful gains	1097.6218	1197.4361	1292.7303	1315.8006	1141.4560	787.1805	479.6990	493.7414	834.8673	1024.1061	1031.9475	1041.8898 (95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000 (96)
Heat loss rate W												
	2602.1151	2375.0891	2136.0025	1742.4272	1294.3366	811.2399	482.7712	498.3178	908.2295	1448.0172	1958.7893	2445.5535 (97)
Space heating kWh												
	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98a)
Space heating requirement - total per year (kWh/year)												
												4986.0763
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

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Space heating kWh	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4986.0763
Space heating per m2												(98c) / (4) = 19.6736 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												337.4099 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98)
Space heating efficiency (main heating system 1)	337.4099	337.4099	337.4099	337.4099	337.4099	0.0000	0.0000	0.0000	0.0000	337.4099	337.4099	337.4099 (210)
Space heating fuel (main heating system)	331.7458	234.5464	185.9443	91.0380	33.7107	0.0000	0.0000	0.0000	0.0000	93.4738	197.7791	309.5125 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726 (216)
Fuel for water heating, kWh/month	135.4506	119.6989	127.0571	111.5878	108.0580	97.2598	95.9639	99.8706	101.0620	112.8137	120.0864	133.9665 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1477.7506 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9726
Water heating fuel used												1362.8754 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)
Electricity for lighting (calculated in Appendix L)												476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												4006.2528 (238)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1477.7506	26.0600	385.1018 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8754	26.0600	355.1653 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1044.0295 (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	1477.7506	0.1560	230.5473 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.8754	0.1409	192.0412 (264)
Space and water heating			422.5886 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Total CO2, kg/year			586.9544 (272)

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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	1477.7506	1.5776	2331.2483 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8754	1.5210	2072.9746 (278)
Space and water heating			4404.2230 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Total Primary energy kWh/year			6177.6123 (286)

SAP 10 EPC IMPROVEMENTS

PLOT 1

Current energy efficiency rating: B 87
Current environmental impact rating: A 97

N Solar water heating SAP increase too small
U Solar photovoltaic panels Recommended
V2 Wind turbine Recommended

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.1	-£ 324	-237 kg (40.4%)
V2 Wind turbine	+ 9.2	-£ 715	-496 kg (141.7%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 78 -37 kg (6.3%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£324	0.94 kg/m ²	B 91 A 98
Wind turbine	£715	1.96 kg/m ²	A 100 A 101
Total Savings	£1039	2.89 kg/m ²	

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 567 TEST (07 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1044	£1044	£0
Space heating	£565	£565	£0
Water heating	£355	£355	£0
Lighting	£124	£124	£0
Generated (PV)	-£0	-£324	£324
Generated (wind)	-£0	-£715	£715
Total cost of fuels	£1044	£5	£1039
Total cost of uses	£1044	£5	£1039
Delivered energy	16 kWh/m ²	-6 kWh/m ²	21 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	-0.1 tonnes	0.7 tonnes
CO2 emissions per m ²	2 kg/m ²	-1 kg/m ²	3 kg/m ²
Primary energy	24 kWh/m ²	-0 kWh/m ²	25 kWh/m ²

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

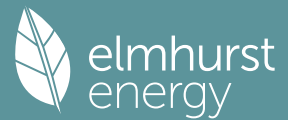
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (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)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												
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	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.3258	34.2841		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 92.0197		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
List of Thermal Bridges 97.0464 (35)

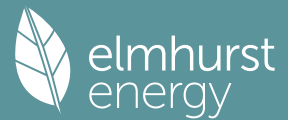
	Length	Psi-value	Total
K1 Element	24.1300	0.2200	5.3086
E2 Other lintels (including other steel lintels)	23.1300	0.0120	0.2776
E3 Sill	41.4000	0.0100	0.4140
E4 Jamb	40.4000	0.0650	2.6260
E5 Ground floor (normal)	24.8000	0.0360	0.8928
E10 Eaves (insulation at ceiling level)	15.6000	0.0550	0.8580
E12 Gable (insulation at ceiling level)	14.7600	0.0540	0.7970
E16 Corner (normal)	4.9200	-0.0990	-0.4871
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0700	2.8280
E6 Intermediate floor within a dwelling			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 105.5346 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 68.8963 Feb 67.8726 Mar 66.8489 Apr 61.7303 May 60.7066 Jun 55.5880 Jul 55.5880 Aug 54.5642 Sep 57.6354 Oct 60.7066 Nov 62.7540 Dec 64.8014 (38)
Heat transfer coeff 174.4309 173.4072 172.3835 167.2649 166.2412 161.1226 161.1226 160.0989 163.1700 166.2412 168.2886 170.3360 (39)
Average = Sum(39)m / 12 = 167.0090
HLP Jan 0.6883 Feb 0.6842 Mar 0.6802 Apr 0.6600 May 0.6559 Jun 0.6357 Jul 0.6357 Aug 0.6317 Sep 0.6438 Oct 0.6559 Nov 0.6640 Dec 0.6721 (40)
HLP (average) 0.6590
Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0714 (42)
Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)
Hot water usage for baths 87.3557 86.0583 84.2314 80.8628 78.3405 75.5436 74.0329 75.8470 77.8223 80.8151 84.2530 87.0603 (42b)
Hot water usage for other uses 46.0842 44.4084 42.7326 41.0569 39.3811 37.7053 37.7053 39.3811 41.0569 42.7326 44.4084 46.0842 (42c)
Average daily hot water use (litres/day) 122.8872 (43)
Daily hot water use Jan 133.4399 Feb 130.4667 Mar 126.9640 Apr 121.9197 May 117.7215 Jun 113.2489 Jul 111.7381 Aug 115.2281 Sep 118.8792 Oct 123.5477 Nov 128.6614 Dec 133.1446 (44)
Energy conte 211.3362 185.7829 195.1390 166.9019 158.4758 139.2527 135.1376 142.6764 146.5899 167.6531 183.3018 208.4722 (45)
Energy content (annual) Total = Sum(45)m = 2040.7195
Distribution loss (46)m = 0.15 x (45)m 31.7004 27.8674 29.2708 25.0353 23.7714 20.8879 20.2706 21.4015 21.9885 25.1480 27.4953 31.2708 (46)
Water storage loss: Store volume 200.0000 (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 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month 261.3826 230.9861 245.1854 215.3339 208.5222 187.6847 185.1840 192.7228 195.0219 217.6995 231.7338 258.5186 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

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PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
Total per year (kWh/year) = Sum(64)m =													2629.9755 (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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North						2.8800	10.6334	0.6300	0.7000	0.7700		9.3591 (74)
East						10.9200	19.6403	0.6300	0.7000	0.7700		65.5453 (76)
West						12.0600	19.6403	0.6300	0.7000	0.7700		72.3880 (80)
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (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	39.1677	39.3990	39.6330	40.8458	41.0973	42.4029	42.4029	42.6741	41.8708	41.0973	40.5973	40.1093	
alpha	3.6112	3.6266	3.6422	3.7231	3.7398	3.8269	3.8269	3.8449	3.7914	3.7398	3.7065	3.6740	
util living area	0.9809	0.9697	0.9430	0.8764	0.7582	0.5849	0.4407	0.4896	0.7260	0.9135	0.9700	0.9838	(86)
Living	19.5736	19.7492	20.0458	20.4319	20.7079	20.8648	20.9050	20.8987	20.7905	20.4174	19.9461	19.5675	
Non living	18.6250	18.8509	19.2288	19.7233	20.0564	20.2463	20.2845	20.2833	20.1647	19.7149	19.1164	18.6278	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2703	19.7492	20.0458	20.4319	20.7079	20.8648	20.9050	20.8987	20.7905	20.4174	19.9461	19.7679	(87)
Th 2	20.3512	20.3548	20.3584	20.3763	20.3799	20.3979	20.3979	20.4016	20.3907	20.3799	20.3727	20.3655	(88)
util rest of house	0.9785	0.9659	0.9357	0.8607	0.7286	0.5395	0.3843	0.4318	0.6843	0.8991	0.9656	0.9817	(89)
MIT 2	19.6630	18.8509	19.2288	19.7233	20.0564	20.2463	20.2845	20.2833	20.1647	19.7149	19.1164	18.9410	(90)
Living area fraction	fLA = Living area / (4) =												0.0833 (91)
MIT	19.7136	18.9257	19.2969	19.7824	20.1107	20.2978	20.3362	20.3346	20.2168	19.7735	19.1856	19.0099	(92)
Temperature adjustment													0.0000
adjusted MIT	19.7136	18.9257	19.2969	19.7824	20.1107	20.2978	20.3362	20.3346	20.2168	19.7735	19.1856	19.0099	(93)

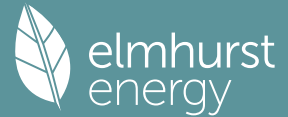
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1080.0332	1187.8473	1287.8343	1319.2778	1191.7325	871.2206	592.3332	615.1234	882.7278	1020.7416	1014.0682	1028.5523	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2688.6149	2432.1608	2205.9748	1820.2367	1398.1999	918.0453	601.9907	629.9180	998.0826	1525.0065	2033.8612	2522.6565	(97)
Space heating kWh	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135	(98a)
Space heating requirement - total per year (kWh/year)													5451.3997
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	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5451.3997
Space heating per m2													21.5096 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	338.1787	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1196.7847	836.1787	683.0966	360.6904	153.6118	0.0000	0.0000	0.0000	0.0000	375.1730	734.2510	1111.6135 (98)
Space heating efficiency (main heating system 1)	338.1787	338.1787	338.1787	338.1787	338.1787	0.0000	0.0000	0.0000	0.0000	338.1787	338.1787	338.1787 (210)
Space heating fuel (main heating system)	353.8913	247.2594	201.9928	106.6568	45.4233	0.0000	0.0000	0.0000	0.0000	110.9393	217.1192	328.7060 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047	192.9047 (216)
Fuel for water heating, kWh/month	135.4983	119.7411	127.1018	111.6271	108.0960	97.2940	95.9977	99.9058	101.0976	112.8534	120.1287	134.0137 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-40.4904	-61.7116	-95.5531	-114.2434	-128.1452	-119.6451	-118.2192	-108.2848	-91.4913	-72.7558	-45.7688	-34.3691 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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	-9.5961	-21.8684	-46.7931	-76.5286	-107.5376	-112.0686	-110.4323	-91.4892	-64.9718	-34.0900	-13.6410	-7.5448 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (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												1611.9880 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9047
Water heating fuel used												1363.3551 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)
Electricity for lighting (calculated in Appendix L)												476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1727.2394 (233)
Wind generation												-3575.5408 (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												-1161.8102 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1611.9880	16.4900	265.8168 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1363.3551	16.4900	224.8173 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	16.4900	113.5844 (249)
Energy for lighting	476.8188	16.4900	78.6274 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1030.6778	16.4900	-169.9588
PV Unit electricity exported	-696.5616	5.5900	-38.9378
Total			-208.8966 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			1.2629 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.0015 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	99.9753
SAP rating (Section 12)		100 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1611.9880	0.1556	250.8503 (261)
Total CO2 associated with community systems			0.0000 (373)

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Water heating (other fuel)	1363.3551	0.1409	192.1088 (264)
Space and water heating			442.9591 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1030.6778	0.1334	-137.5230
PV Unit electricity exported	-696.5616	0.1235	-85.9964
Total			-223.5194 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			-112.1660 (272)
CO2 emissions per m2			-0.4400 (273)
EI value			100.5036
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)

2. Ventilation rate

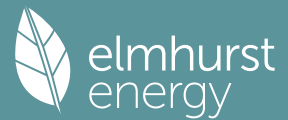
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Adj infilt rate	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
Balanced mechanical ventilation with heat recovery	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.3258	34.2841		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.0197		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086	
E3 Sill				23.1300	0.0120	0.2776	
E4 Jamb				41.4000	0.0100	0.4140	
E5 Ground floor (normal)				40.4000	0.0650	2.6260	

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E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	105.5346 (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	63.7777	62.7540	62.7540	57.6354	56.6117	52.5168	52.5168	52.5168	54.5642	57.6354	57.6354	59.6828
Average = Sum(39)m / 12 =	169.3123	168.2886	168.2886	163.1700	162.1463	158.0514	158.0514	158.0514	160.0989	163.1700	163.1700	165.2175
												163.0847
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6681	0.6640	0.6640	0.6438	0.6398	0.6236	0.6236	0.6236	0.6317	0.6438	0.6438	0.6519
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
												0.6435
												0.6435

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0714 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												87.0603 (42b)
Hot water usage for other uses												46.0842 (42c)
Average daily hot water use (litres/day)												122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722
Distribution loss (46)m = 0.15 x (45)m												2040.7195
Water storage loss:												
Store volume												200.0000 (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												
If cylinder contains dedicated solar storage												
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
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
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
WWHRS	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electric shower(s)												
Heat gains from water heating, kWh/month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)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
Total per year (kWh/year) = Sum(64)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
Heat gains from water heating, kWh/month	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541

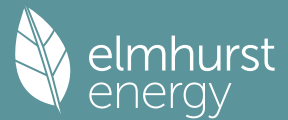
5. Internal gains (see Table 5 and 5a)

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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015
Pumps, fans	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561
Total internal gains	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814
	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		2.8800	12.0246	0.6300	0.7000	0.7700	10.5837 (74)
East		10.9200	22.3829	0.6300	0.7000	0.7700	74.6984 (76)
West		12.0600	22.3829	0.6300	0.7000	0.7700	82.4966 (80)
Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810
							775.9702
							605.8185
							373.5601
							208.7025
							136.7391
							1069.3244

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3519	40.5973	40.5973	41.8708	42.1352	43.2269	43.2269	43.2269	42.6741	41.8708	41.8708	41.3520
alpha	3.6901	3.7065	3.7065	3.7914	3.8090	3.8818	3.8818	3.8818	3.8449	3.7914	3.7914	3.7568
util living area	0.9791	0.9681	0.9375	0.8584	0.7217	0.5119	0.3559	0.3920	0.6671	0.8953	0.9655	0.9824 (86)
Living	19.6531	19.8095	20.1150	20.5031	20.7611	20.8907	20.9151	20.9127	20.8352	20.4944	20.0318	19.6444
Non living	18.7394	18.9408	19.3268	19.8218	20.1299	20.2820	20.3036	20.3020	20.2218	19.8179	19.2385	18.7392
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3110	19.8095	20.1150	20.5031	20.7611	20.8907	20.9151	20.9127	20.8352	20.4944	20.0318	19.8340 (87)
Th 2	20.3691	20.3727	20.3727	20.3907	20.3943	20.4088	20.4088	20.4088	20.4016	20.3907	20.3907	20.3835 (88)
util rest of house	0.9765	0.9641	0.9295	0.8410	0.6895	0.4655	0.3007	0.3335	0.6211	0.8783	0.9605	0.9802 (89)
MIT 2	19.7194	18.9408	19.3268	19.8218	20.1299	20.2820	20.3036	20.3020	20.2218	19.8179	19.2385	19.0355 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.7687	19.0132	19.3925	19.8786	20.1825	20.3328	20.3545	20.3529	20.2729	19.8743	19.3046	19.1020 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.7687	19.0132	19.3925	19.8786	20.1825	20.3328	20.3545	20.3529	20.2729	19.8743	19.3046	19.1020 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9736	0.9532	0.9145	0.8246	0.6774	0.4593	0.2955	0.3279	0.6106	0.8613	0.9492	0.9743 (94)
Useful gains	1097.6218	1197.4361	1292.7303	1315.8006	1141.4560	787.1805	479.6990	493.7414	834.8673	1024.1061	1031.9475	1041.8898 (95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000 (96)
Heat loss rate W	2602.1151	2375.0891	2136.0025	1742.4272	1294.3366	811.2399	482.7712	498.3178	908.2295	1448.0172	1958.7893	2445.5535 (97)
Space heating kWh	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98a)
Space heating requirement - total per year (kWh/year)	4986.0763											
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	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4986.0763											
Space heating per m2	(98c) / (4) = 19.6736 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	337.4099 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1119.3430	791.3828	627.3945	307.1711	113.7432	0.0000	0.0000	0.0000	0.0000	315.3898	667.3261	1044.3258 (98)
Space heating efficiency (main heating system 1)	337.4099	337.4099	337.4099	337.4099	337.4099	0.0000	0.0000	0.0000	0.0000	337.4099	337.4099	337.4099 (210)
Space heating fuel (main heating system)	331.7458	234.5464	185.9443	91.0380	33.7107	0.0000	0.0000	0.0000	0.0000	93.4738	197.7791	309.5125 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726	192.9726 (216)
Fuel for water heating, kWh/month	135.4506	119.6989	127.0571	111.5878	108.0580	97.2598	95.9639	99.8706	101.0620	112.8137	120.0864	133.9665 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (221)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.8860	-63.2327	-96.8850	-116.8280	-128.8115	-125.9212	-123.1818	-113.8323	-97.0852	-77.1457	-50.4738	-37.8124 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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)	-11.5159	-23.0224	-48.6368	-81.3727	-110.6369	-124.5996	-120.2352	-101.1531	-72.8260	-38.5414	-16.3205	-8.9203 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (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	1477.7506 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	192.9726											
Water heating fuel used	1362.8754 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)	688.8080 (230a)											
Total electricity for the above, kWh/year	688.8080 (231)											

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Electricity for lighting (calculated in Appendix L)	476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1833.8762 (233)
Wind generation	-3575.5408 (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	-1403.1641 (238)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1477.7506	26.0600	385.1018 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8754	26.0600	355.1653 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1076.0955	26.0600	-280.4305
PV Unit electricity exported	-757.7807	5.8100	-44.0271
Total			-324.4575 (252)
Wind Turbine electricity used in dwelling	-2502.8785	26.0600	-652.2501
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-714.5718 (252)
Total energy cost			5.0001 (255)

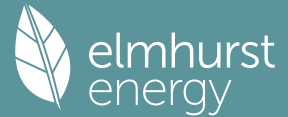
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1477.7506	0.1560	230.5473 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.8754	0.1409	192.0412 (264)
Space and water heating			422.5886 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1076.0955	0.1335	-143.6207
PV Unit electricity exported	-757.7807	0.1232	-93.3865
Total			-237.0071 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			-146.0243 (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	1477.7506	1.5776	2331.2483 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8754	1.5210	2072.9746 (278)
Space and water heating			4404.2230 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1076.0955	1.4932	-1606.8188
PV Unit electricity exported	-757.7807	0.4522	-342.6469
Total			-1949.4657 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			-108.2692 (286)

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Property Reference	CLEAN				Issued on Date	01/04/2025
Assessment Reference	PLOT 1		Prop Type Ref			
Property	Land between, Shangri-La & Todds Corner, Todds Green, Stevenage, Hertfordshire, SG1 2JE					
SAP Rating	87 B	DER	2.39	TER	7.19	
Environmental	97 A	% DER < TER				66.76
CO ₂ Emissions (t/year)	0.58	DFEE	32.66	TFEE	33.66	
Compliance Check	See BREL	% DFEE < TFEE				2.97
% DPER < TPER	33.26	DPER	25.16	TPER	37.70	
Assessor Details	Mr. Paul Allen				Assessor ID	8075-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Main dwelling						
Ground floor	96.7200 (1b)	x	2.4000 (2b)	=	232.1280 (1b)	- (3b)
First floor	96.7200 (1c)	x	2.6500 (2c)	=	256.3080 (1c)	- (3c)
Second floor	60.0000 (1d)	x	2.2000 (2d)	=	132.0000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360	(5)

2. Ventilation rate

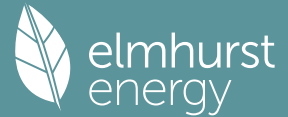
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000	(23c)
Effective ac	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m ²)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24595.4400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.0464	(35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	101.4660 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014	(38)
Heat transfer coeff	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674	(39)
Average = Sum(39)m / 12 =												162.9403	
HLP	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560	(40)
HLP (average)												0.6429	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)												122.8872	(43)
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7195	
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume												200.0000	(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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2629.9755	(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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(65)

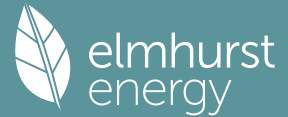
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	879.9098	907.7958	866.0566	840.6850	796.8563	770.7495	740.2254	739.2428	762.2488	784.7169	832.0178	860.1263	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.8800	10.6334	0.6300	0.7000	0.7700	9.3591 (74)
East	10.9200	19.6403	0.6300	0.7000	0.7700	65.5453 (76)
West	12.0600	19.6403	0.6300	0.7000	0.7700	72.3880 (80)

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Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	1027.2022	1195.5084	1340.8153	1537.5848	1656.8670	1654.2046	1580.0144	1456.2966	1315.6067	1126.1799	1015.5502	981.3582 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394
util living area	0.9847	0.9726	0.9479	0.8772	0.7533	0.5702	0.4274	0.4767	0.7171	0.9167	0.9733	0.9869 (86)
Living	19.5612	19.7591	20.0496	20.4506	20.7241	20.8741	20.9090	20.9035	20.8039	20.4289	19.9520	19.5599
Non living	18.6198	18.8743	19.2450	19.7582	20.0879	20.2695	20.3025	20.3020	20.1923	19.7408	19.1349	18.6287
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2640	19.7591	20.0496	20.4506	20.7241	20.8741	20.9090	20.9035	20.8039	20.4289	19.9520	19.7613 (87)
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798 (88)
util rest of house	0.9828	0.9691	0.9412	0.8618	0.7239	0.5261	0.3736	0.4211	0.6758	0.9029	0.9694	0.9852 (89)
MIT 2	19.6695	18.8743	19.2450	19.7582	20.0879	20.2695	20.3025	20.3020	20.1923	19.7408	19.1349	18.9443 (90)
Living area fraction										FLA = Living area / (4) =		0.0833 (91)
MIT	19.7191	18.9480	19.3120	19.8159	20.1409	20.3199	20.3530	20.3521	20.2433	19.7982	19.2030	19.0124 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7191	18.9480	19.3120	19.8159	20.1409	20.3199	20.3530	20.3521	20.2433	19.7982	19.2030	19.0124 (93)

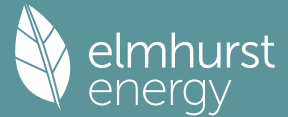
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9804	0.9591	0.9272	0.8452	0.7107	0.5189	0.3680	0.4149	0.6636	0.8867	0.9596	0.9805 (94)
Useful gains	1007.0794	1146.6053	1243.2310	1299.5348	1177.4754	858.3766	581.4695	604.2104	873.0763	998.5368	974.4731	962.1984 (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	2626.8293	2378.8679	2156.4544	1781.4342	1368.8820	898.3287	589.4313	616.6439	977.4006	1491.6898	1987.5481	2462.8145 (97)
Space heating kWh	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98a)
Space heating requirement - total per year (kWh/year)												5414.7648
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	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5414.7648
Space heating per m2										(98c) / (4) =		21.3651 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												337.3809 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98)
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809 (210)
Space heating fuel (main heating system)	357.1909	245.4437	201.3861	102.8415	42.2094	0.0000	0.0000	0.0000	0.0000	108.7512	216.1989	330.9192 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751 (216)
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1604.9409 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9751

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Water heating fuel used	1362.8573 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100) mechanical ventilation fans (SFP = 0.9100)	688.8080 (230a)
Total electricity for the above, kWh/year	688.8080 (231)
Electricity for lighting (calculated in Appendix L)	476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4133.4251 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1604.9409	0.1557	249.9592 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1362.8573	0.1409	192.0387 (264)	
Space and water heating			441.9979 (265)	
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)	
Energy for lighting	476.8188	0.1443	68.8197 (268)	
Total CO2, kg/year			606.3637 (272)	
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.3900 (273)	

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1604.9409	1.5766	2530.2921 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1362.8573	1.5210	2072.9471 (278)	
Space and water heating			4603.2392 (279)	
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)	
Energy for lighting	476.8188	1.5338	731.3605 (282)	
Total Primary energy kWh/year			6376.6285 (286)	
Dwelling Primary energy Rate (DPER)			25.1600 (287)	

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

1. Overall dwelling characteristics

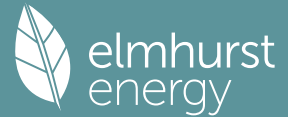
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)	
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)	
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0645 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3145	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695	(22b)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			4.0600	1.0000	4.0600		(26)
TER Opening Type			25.8600	1.1450	29.6107		(27)
Heatloss Floor 1			96.7200	0.1300	12.5736		(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344		(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392		(30)
Total net area of external elements Aum(A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		88.2179		(33)

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

97.0464 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	24.1300	0.0500	1.2065
E3 Sill	23.1300	0.0500	1.1565
E4 Jamb	41.4000	0.0500	2.0700
E5 Ground floor (normal)	40.4000	0.1600	6.4640
E10 Eaves (insulation at ceiling level)	24.8000	0.0600	1.4880
E12 Gable (insulation at ceiling level)	15.6000	0.0600	0.9360
E16 Corner (normal)	14.7600	0.0900	1.3284
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428
E6 Intermediate floor within a dwelling	40.4000	0.0000	0.0000

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

14.2066 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 102.4245 (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	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490 (38)
Average = Sum(39)m / 12 =	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735 (39)
												217.0435

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632 (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												3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603 (42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842 (42c)
Average daily hot water use (litres/day)												122.8872 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446 (44)
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722 (45)
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708 (46)

Water storage loss:

Store volume

200.0000 (47)

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

1.6525 (48)

Temperature factor from Table 2b

0.5400 (49)

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

0.8924 (55)

Total storage loss

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
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If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
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Total heat required for water heating calculated for each month

262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983 (62)
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WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
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FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
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FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
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Output from w/h

262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983 (64)
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12Total per year (kWh/year)

Total per year (kWh/year) = Sum(64a)m = 2640.3329 (64)

Electric shower(s)

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

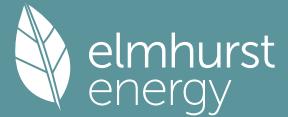
Heat gains from water heating, kWh/month

111.0101	98.5710	105.6246	94.9215	93.4341	85.7282	85.6741	88.1808	88.1678	96.4855	100.3745	110.0579 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)												

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Total internal gains	149.2072	146.6831	141.9685	131.8354	125.5834	119.0669	115.1534	118.5225	122.4553	129.6848	139.4090	147.9272 (72)
	883.8556	911.7417	870.0025	844.6309	800.8022	771.6953	741.1713	740.1887	763.1946	788.6628	835.9637	864.0722 (73)

6. Solar gains

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

North					2.8800	10.6334	0.6300	0.7000			0.7700			9.3591 (74)
East					10.9200	19.6403	0.6300	0.7000			0.7700			65.5453 (76)
West					12.0600	19.6403	0.6300	0.7000			0.7700			72.3880 (80)

Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323			121.2319 (83)
Total gains	1031.1481	1199.4543	1344.7612	1541.5306	1660.8129	1655.1505	1580.9603	1457.2425	1316.5525	1130.1258	1019.4960			985.3041 (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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area	0.9854	0.9759	0.9580	0.9107	0.8236	0.6818	0.5415	0.5945	0.8003	0.9377	0.9768	0.9873 (86)
MIT	18.5679	18.8359	19.2702	19.8829	20.4096	20.7791	20.9218	20.8938	20.6063	19.9099	19.1476	18.5369 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house	0.9833	0.9725	0.9517	0.8965	0.7939	0.6263	0.4611	0.5153	0.7564	0.9251	0.9729	0.9855 (89)
MIT 2	17.2758	17.6186	18.1720	18.9482	19.5926	20.0212	20.1628	20.1416	19.8381	18.9927	18.0244	17.2412 (90)
Living area fraction	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	0.0833 (91)
MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9722	0.9571	0.9308	0.8702	0.7701	0.6162	0.4622	0.5139	0.7363	0.9010	0.9579	0.9755 (94)
Useful gains	1002.4700	1148.0306	1251.7250	1341.3764	1279.0599	1019.8347	730.7806	748.8851	969.3861	1018.2201	976.5958	961.1563 (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	2894.7741	2828.2992	2587.8381	2197.8247	1723.4597	1173.2879	775.7363	812.0522	1246.9881	1833.5383	2397.6149	2876.6834 (97)
Space heating kWh	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98a)
Space heating requirement - total per year (kWh/year)												7533.2417
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	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7533.2417
Space heating per m2										(98c) / (4) =		29.7240 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1525.3242	1223.3375	1076.9969	668.0854	358.2161	0.0000	0.0000	0.0000	0.0000	657.2012	1108.4872	1544.0435 (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	262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983 (64)
Efficiency of water heater	87.2547	87.1265	86.8563	86.2742	85.0793	79.8000	79.8000	79.8000	79.8000	86.2241	86.9830	79.8000 (216)
Fuel for water heating, kWh/month	300.5709	266.0278	283.3012	250.5791	246.1255	236.2606	233.1625	242.6097	245.4551	253.5013	267.3916	87.2841 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	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	50.5346	40.5408	36.5025	26.7433	20.6573	16.8772	18.8443	24.4945	31.8159	41.7442	47.1500	51.9391 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-84.4391	-116.0247	-162.4452	-177.5451	-186.9889	-172.6716	-170.3033	-162.8427	-149.1869	-130.0603	-91.6615	-73.3413 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-57.1780	-119.1060	-234.7249	-349.7752	-460.0045	-461.5536	-456.3348	-387.6663	-285.7227	-169.6437	-76.0855	-45.3225	(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												8161.6920	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												79.8000		
Water heating fuel used												3122.1735	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												86.0000	(231)	
Electricity for lighting (calculated in Appendix L)												407.8434	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-4780.6283	(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												6997.0807	(238)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8161.6920	0.2100	1713.9553 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3122.1735	0.2100	655.6564 (264)
Space and water heating			2369.6118 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	407.8434	0.1443	58.8644 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1677.5106	0.1352	-226.8003
PV Unit electricity exported	-3103.1178	0.1261	-391.3578
Total			-618.1581 (269)
Total CO2, kg/year			1822.2473 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.1900 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8161.6920	1.1300	9222.7120 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3122.1735	1.1300	3528.0561 (278)
Space and water heating			12750.7681 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	407.8434	1.5338	625.5639 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1677.5106	1.4997	-2515.7840
PV Unit electricity exported	-3103.1178	0.4629	-1436.5799
Total			-3952.3639 (283)
Total Primary energy kWh/year			9554.0689 (286)
Target Primary Energy Rate (TPER)			37.7000 (287)

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

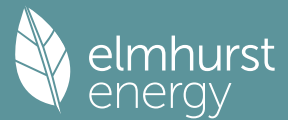
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	620.4360 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

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

Air changes per hour
40.0000 / (5) = 0.0645 (8)
Yes
Blower Door
4.0000 (17)
0.2645 (18)
0 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
(21) = (18) x (20) = 0.2645 (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 infiltr rate	0.3372	0.3306	0.3240	0.2909	0.2843	0.2512	0.2512	0.2446	0.2645	0.2843	0.2975	0.3108	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5569	0.5546	0.5525	0.5423	0.5404	0.5316	0.5316	0.5299	0.5350	0.5404	0.5443	0.5483	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)					87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
97.0464 (35)

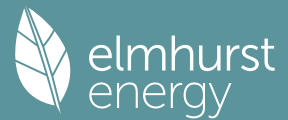
List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	24.1300	0.2200	5.3086	
E2 Other lintels (including other steel lintels)	23.1300	0.0120	0.2776	
E3 Sill	41.4000	0.0100	0.4140	
E4 Jamb	40.4000	0.0650	2.6260	
E5 Ground floor (normal)	24.8000	0.0360	0.8928	
E10 Eaves (insulation at ceiling level)	15.6000	0.0550	0.8580	
E12 Gable (insulation at ceiling level)	14.7600	0.0540	0.7970	
E16 Corner (normal)	4.9200	-0.0990	-0.4871	
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0700	2.8280	
E6 Intermediate floor within a dwelling				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss			101.4660	(37)
				(33) + (36) + (36a) =

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	114.0120	113.5600	113.1170	111.0360	110.6467	108.8342	108.8342	108.4985	109.5323	110.6467	111.4343	112.2577	(38)
Average = Sum(39)m / 12 =	215.4780	215.0260	214.5830	212.5020	212.1127	210.3002	210.3002	209.9645	210.9983	212.1127	212.9003	213.7237	(39)
												212.5001	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8502	0.8484	0.8467	0.8385	0.8369	0.8298	0.8298	0.8285	0.8325	0.8369	0.8400	0.8433	(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													3.0714	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	32.6841	32.1987	31.5151	30.2548	29.3111	28.2646	27.6994	28.3781	29.1172	30.2369	31.5232	32.5736	32.5736	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	46.0842	(42c)
Average daily hot water use (litres/day)													72.1981	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317	78.6578	78.6578	(44)
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786	123.1591	123.1591	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853	104.6853	(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	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	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	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	0.0000	(63d)
Output from w/h	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853	104.6853	(64)
12Total per year (kWh/year)													1019.1973	(64)
Electric shower(s)													1019	(64)

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	60.6369	54.0279	58.9964	56.2996	57.3560	54.7121	56.5358	57.3560	56.2996	58.9964	57.8871	60.6369 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											689.7407 (64a)
Heat gains from water heating, kWh/month	41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597	41.3305 (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
	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518 (72)
Total internal gains	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					2.8800	10.6334		0.6300	0.7000	0.7700		9.3591 (74)
East					10.9200	19.6403		0.6300	0.7000	0.7700		65.5453 (76)
West					12.0600	19.6403		0.6300	0.7000	0.7700		72.3880 (80)
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	934.9470	1104.3666	1252.2104	1455.0557	1577.9143	1579.0218	1507.3969	1381.9562	1239.1846	1045.5466	929.1144	889.9286 (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	31.7066	31.7732	31.8388	32.1506	32.2096	32.4872	32.4872	32.5391	32.3797	32.2096	32.0905	31.9668
alpha	3.1138	3.1182	3.1226	3.1434	3.1473	3.1658	3.1658	3.1693	3.1586	3.1473	3.1394	3.1311
util living area	0.9888	0.9805	0.9643	0.9199	0.8359	0.6962	0.5557	0.6117	0.8168	0.9474	0.9818	0.9904 (86)
MIT	18.5505	18.8191	19.2535	19.8655	20.3980	20.7723	20.9190	20.8887	20.5907	19.8808	19.1172	18.5115 (87)
Th 2	20.2100	20.2116	20.2131	20.2201	20.2214	20.2276	20.2276	20.2287	20.2252	20.2214	20.2188	20.2160 (88)
util rest of house	0.9872	0.9777	0.9589	0.9071	0.8077	0.6417	0.4754	0.5329	0.7753	0.9366	0.9787	0.9891 (89)
MIT 2	17.9151	18.1833	18.6152	19.2209	19.7306	20.0704	20.1848	20.1664	19.9192	19.2439	18.4863	17.8803 (90)
Living area fraction									fLA = Living area / (4) =			0.0833 (91)
MIT	17.9680	18.2362	18.6684	19.2746	19.7862	20.1289	20.2460	20.2266	19.9752	19.2970	18.5389	17.9329 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9680	18.2362	18.6684	19.2746	19.7862	20.1289	20.2460	20.2266	19.9752	19.2970	18.5389	17.9329 (93)

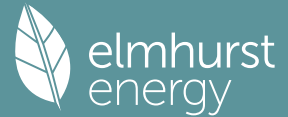
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9807	0.9680	0.9449	0.8879	0.7895	0.6341	0.4774	0.5327	0.7597	0.9198	0.9694	0.9833 (94)
Useful gains	916.8692	1069.0236	1183.1900	1291.8804	1245.8138	1001.2700	719.6054	736.1395	941.3843	961.7417	900.6877	875.0393 (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	2945.1629	2867.6408	2611.1395	2204.6305	1715.1858	1162.7310	766.7507	803.4534	1239.6519	1844.7369	2435.3391	2935.0423 (97)
Space heating kWh	1509.0506	1208.6708	1062.3944	657.1801	349.2127	0.0000	0.0000	0.0000	0.0000	656.9484	1104.9490	1532.6423 (98a)
Space heating requirement - total per year (kWh/year)												8081.0482
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	1509.0506	1208.6708	1062.3944	657.1801	349.2127	0.0000	0.0000	0.0000	0.0000	656.9484	1104.9490	1532.6423 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8081.0482
Space heating per m2										(98c) / (4) =		31.8854 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	1976.8217	1556.2213	1595.7305	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7025	0.7778	0.7337	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1388.6283	1210.3882	1170.8363	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	231.8444	313.9354	238.1521	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	57.9611	78.4839	59.5380	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												195.9830 (107)

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Energy for space heating	31.8854 (99)
Energy for space cooling	0.7733 (108)
Total	32.6587 (109)
Fabric Energy Efficiency (DFEE)	32.7 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0645 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3145 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Opaque door			4.0600	1.0000	4.0600		(26)
TER Opening Type			25.8600	1.1450	29.6107		(27)
Heatloss Floor 1			96.7200	0.1300	12.5736		(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344		(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392		(30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	88.2179	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 97.0464 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	24.1300	0.0500	1.2065
E2 Other lintels (including other steel lintels)	23.1300	0.0500	1.1565
E3 Sill	41.4000	0.0500	2.0700
E4 Jamb	40.4000	0.1600	6.4640
E5 Ground floor (normal)	24.8000	0.0600	1.4880
E10 Eaves (insulation at ceiling level)	15.6000	0.0600	0.9360
E12 Gable (insulation at ceiling level)	14.7600	0.0900	1.3284
E16 Corner (normal)	4.9200	-0.0900	-0.4428
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0000	0.0000
E6 Intermediate floor within a dwelling			

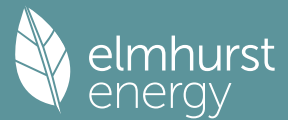
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.2066 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 102.4245 (37)

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	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490 (38)
Heat transfer coeff	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735 (39)
Average = Sum(39)m / 12 =												217.0435

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632 (40)
HLP (average)												0.8564
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.6841	32.1987	31.5151	30.2548	29.3111	28.2646	27.6994	28.3781	29.1172	30.2369	31.5232	32.5736 (42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842 (42c)
Average daily hot water use (litres/day)												72.1981 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317	78.6578 (44)
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786	123.1591 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1199.0556											
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853 (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	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m = 1019.1973 (64)											1019 (64)
Electric shower(s)	60.6369	54.0279	58.9964	56.2996	57.3560	54.7121	56.5358	57.3560	56.2996	58.9964	57.8871	60.6369 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 689.7407 (64a)											
Heat gains from water heating, kWh/month	41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597	41.3305 (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	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518 (72)
Total internal gains	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968 (73)

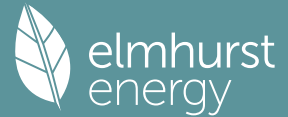
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g		FF		Access factor Table 6d		Gains W

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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area	0.9888	0.9806	0.9648	0.9215	0.8394	0.7014	0.5617	0.6174	0.8204	0.9482	0.9819	0.9904 (86)
MIT	18.4847	18.7563	19.1973	19.8253	20.3700	20.7597	20.9132	20.8817	20.5725	19.8475	19.0713	18.4536 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house	0.9872	0.9778	0.9594	0.9087	0.8113	0.6464	0.4800	0.5375	0.7788	0.9375	0.9788	0.9890 (89)
MIT 2	17.8365	18.1080	18.5471	19.1707	19.6930	20.0495	20.1695	20.1508	19.8924	19.2009	18.4298	17.8111 (90)
Living area fraction	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (91)
MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9805	0.9680	0.9452	0.8891	0.7925	0.6383	0.4818	0.5369	0.7626	0.9205	0.9693	0.9831	(94)
Useful gains	916.7032	1068.9724	1183.5741	1293.7186	1250.4727	1007.8247	726.2985	742.0000	945.0545	962.3842	900.6338	874.8918	(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													
Space heating kWh	3006.9495	2925.7977	2662.1454	2241.0627	1742.6687	1178.4865	776.8917	813.6326	1257.0920	1873.7162	2477.1072	2989.4627	(97)
Space heating requirement - total per year (kWh/year)	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98a)
Solar heating kWh												8337.6011	
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	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8337.6011	
Space heating per m2										(98c) / (4) =		32.8977	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6935	0.7693	0.7252	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1394.5270	1217.8658	1176.4606	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	227.5973	308.3721	233.9676	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction													
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	(104)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.8993	77.0930	58.4919	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling requirement													
Energy for space heating													(106)
Energy for space cooling													(107)
Total													(108)
Fabric Energy Efficiency (TFEE)													(109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (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	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22)	
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)	
Adj infilt rate	0.2550 0.2500 0.2450 0.2200 0.2150 0.1900 0.1900 0.1850 0.2000 0.2150 0.2250 0.2350 (22b)	
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		83.7000 (23c)
Effective ac	0.3365 0.3315 0.3265 0.3015 0.2965 0.2715 0.2715 0.2665 0.2815 0.2965 0.3065 0.3165 (25)	

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum (A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)					87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.0464 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5149 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 101.4660 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014
Average = Sum(39)m / 12 =	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560
HLP (average)												0.6429
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

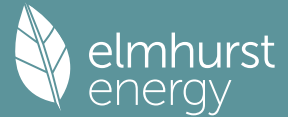
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)													122.8872 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2040.7195	
	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume													200.0000 (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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(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													
	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
										Total per year (kWh/year) = Sum(64)m =		2629.9755	(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													
	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)

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Losses e.g. evaporation (negative values) (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					2.8800	10.6334	0.6300		0.7000		0.7700		9.3591 (74)	
East					10.9200	19.6403	0.6300		0.7000		0.7700		65.5453 (76)	
West					12.0600	19.6403	0.6300		0.7000		0.7700		72.3880 (80)	
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)		
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (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	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908		
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394		
util living area	0.9807	0.9692	0.9415	0.8723	0.7506	0.5746	0.4311	0.4795	0.7174	0.9107	0.9694	0.9836	(86)	
Living	19.6159	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.6104		
Non living	18.6894	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.6931		
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0		
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0		
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10		
MIT	20.2920	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.8048	(87)	
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798	(88)	
util rest of house	0.9783	0.9653	0.9341	0.8564	0.7211	0.5304	0.3769	0.4236	0.6760	0.8962	0.9650	0.9815	(89)	
MIT 2	19.6973	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.9971	(90)	
Living area fraction										FLA = Living area / (4) =		0.0833	(91)	
MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(93)	

8. Space heating requirement

Utilisation	0.9755	0.9546	0.9195	0.8399	0.7080	0.5230	0.3713	0.4173	0.6639	0.8797	0.9544	0.9759	(94)	
Useful gains	1079.7918	1187.2401	1285.9053	1313.4174	1180.4379	857.0932	581.1780	603.9103	872.9105	1017.7415	1013.4936	1028.4185	(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	2631.5571	2385.5042	2163.4446	1783.6387	1369.3333	898.1449	589.3891	616.6007	977.3758	1494.7530	1993.7812	2471.4619	(97)	
Space heating kWh	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98a)	
Space heating requirement - total per year (kWh/year)												5226.0615		
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	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5226.0615		
Space heating per m ²										(98c) / (4) =		20.6205	(99)	

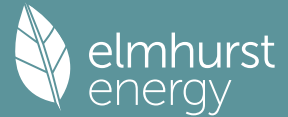
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													337.3809	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98)	
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809	(210)	
Space heating fuel (main heating system)	342.1988	238.6719	193.5169	100.3493	41.6556	0.0000	0.0000	0.0000	0.0000	105.1916	209.2018	318.2232	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)	
Efficiency of water heater (217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	(216)	
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647	(219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015	(231)	
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232	(232)	

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energy

		Area (m ²)		Storey height (m)		Volume (m ³)
Main dwelling						
Ground floor		96.7200 (1b)	x	2.4000 (2b)	=	232.1280 (1b) - (3b)
First floor		96.7200 (1c)	x	2.6500 (2c)	=	256.3080 (1c) - (3c)
Second floor		60.0000 (1d)	x	2.2000 (2d)	=	132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	620.4360 (5)

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2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2000 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
Adj infilt rate	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (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	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)

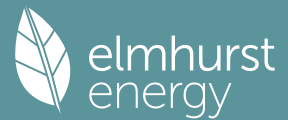
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Main dwelling												
WINDOW			25.8600	1.2357	31.9563			(27)				
DOOR			4.0600	1.5000	6.0900			(26)				
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)				
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)				
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)				
Total net area of external elements Aum(A, m2)			397.4400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511			(33)				
Main dwelling												
Internal Wall 1			100.0000			9.0000	900.0000	(32c)				
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24595.4400	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086						
E3 Sill				23.1300	0.0120	0.2776						
E4 Jamb				41.4000	0.0100	0.4140						
E5 Ground floor (normal)				40.4000	0.0650	2.6260						
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928						
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580						
E16 Corner (normal)				14.7600	0.0540	0.7970						
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871						
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149	(36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	101.4660 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.7777	Feb 62.7540	Mar 62.7540	Apr 57.6354	May 56.6117	Jun 52.5168	Jul 52.5168	Aug 52.5168	Sep 54.5642	Oct 57.6354	Nov 57.6354	Dec 59.6828 (38)
Heat transfer coeff	165.2437	164.2200	164.2200	159.1014	158.0777	153.9828	153.9828	153.9828	156.0302	159.1014	159.1014	161.1488 (39)
Average = Sum(39)m / 12 =												159.0161
HLP	Jan 0.6520	Feb 0.6480	Mar 0.6480	Apr 0.6278	May 0.6237	Jun 0.6076	Jul 0.6076	Aug 0.6076	Sep 0.6156	Oct 0.6278	Nov 0.6278	Dec 0.6358 (40)
HLP (average)												0.6274
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	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 (42b)
Hot water usage for other uses	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	87.0603 (42c)
Average daily hot water use (litres/day)	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	46.0842 (43)
													122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)

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Water storage loss:											
Store volume											200.0000 (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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month											
261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h											
261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Total per year (kWh/year) = Sum(64)m =											2629.9755 (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											
110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541 (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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)												
	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)												
	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814 (72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.8800	12.0246		0.6300		0.7000		0.7700		10.5837 (74)
East				10.9200	22.3829		0.6300		0.7000		0.7700		74.6984 (76)
West				12.0600	22.3829		0.6300		0.7000		0.7700		82.4966 (80)
Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145	775.9702	605.8185	373.5601	208.7025	136.7391	(83)
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810	1505.9578	1367.3018	1188.9618	1087.1327	1069.3244	(84)

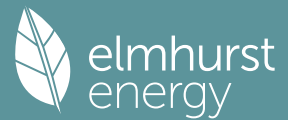
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.3454	41.6031	41.6031	42.9416	43.2197	44.3690	44.3690	44.3690	43.7868	42.9416	42.9416	42.3960
alpha	3.7564	3.7735	3.7735	3.8628	3.8813	3.9579	3.9579	3.9579	3.9191	3.8628	3.8628	3.8264
util living area	0.9788	0.9674	0.9357	0.8535	0.7130	0.5014	0.3474	0.3829	0.6573	0.8917	0.9647	0.9822 (86)
Living	19.6959	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.6879
Non living	18.8047	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	18.8053
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3329	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.8714 (87)
Th 2	20.3834	20.3870	20.3870	20.4051	20.4087	20.4232	20.4232	20.4232	20.4159	20.4051	20.4051	20.3978 (88)
util rest of house												
	0.9762	0.9634	0.9276	0.8359	0.6810	0.4565	0.2946	0.3268	0.6120	0.8745	0.9596	0.9799 (89)
MIT 2	19.7540	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	19.0923 (90)
Living area fraction												
MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	0.0833 (91)
Temperature adjustment												0.0000
adjusted MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9733	0.9526	0.9129	0.8201	0.6697	0.4508	0.2897	0.3215	0.6022	0.8580	0.9485	0.9741 (94)
Useful gains	1097.2760	1196.6763	1290.3696	1308.5751	1128.4313	772.5624	470.2103	484.1128	823.4280	1020.1202	1031.1061	1041.6774 (95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000 (96)
Heat loss rate W	2545.1267	2327.9149	2093.6321	1706.2049	1266.6156	793.2148	472.7560	487.9387	888.7845	1418.5768	1918.7896	2394.2177 (97)
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98a)
Space heating requirement - total per year (kWh/year)												4765.9969
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

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Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4765.9969
Space heating per m2												(98c) / (4) = 18.8052 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												336.5767 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98)
Space heating efficiency (main heating system 1)	336.5767	336.5767	336.5767	336.5767	336.5767	0.0000	0.0000	0.0000	0.0000	336.5767	336.5767	336.5767 (210)
Space heating fuel (main heating system)	320.0462	225.8601	177.5605	85.0604	30.5455	0.0000	0.0000	0.0000	0.0000	88.0785	189.8920	298.9779 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465 (216)
Fuel for water heating, kWh/month	135.3987	119.6531	127.0084	111.5451	108.0165	97.2225	95.9271	99.8323	101.0233	112.7705	120.0404	133.9152 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
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 (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												1416.0212 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.0465
Water heating fuel used												1362.3530 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)
Electricity for lighting (calculated in Appendix L)												476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3944.0010 (238)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1416.0212	26.0600	369.0151 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	26.0600	355.0292 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1027.8067 (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	1416.0212	0.1561	221.0533 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.3530	0.1409	191.9676 (264)
Space and water heating			413.0209 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Total CO2, kg/year			577.3868 (272)

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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	1416.0212	1.5779	2234.3701	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)	1362.3530	1.5210	2072.1801	(278)
Space and water heating			4306.5502	(279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288	(281)
Energy for lighting	476.8188	1.5338	731.3605	(282)
Total Primary energy kWh/year			6079.9395	(286)

SAP 10 EPC IMPROVEMENTS

PLOT 1

Current energy efficiency rating: B 87
Current environmental impact rating: A 97

N Solar water heating SAP increase too small
U Solar photovoltaic panels Recommended
V2 Wind turbine Recommended

Recommended measures:	SAP change	Cost change	CO ₂ change
U Solar photovoltaic panels	+ 4.1	-£ 324	-237 kg (41.1%)
V2 Wind turbine	+ 9.2	-£ 715	-496 kg (145.7%)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 78 -37 kg (6.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£324	0.94 kg/m ²	B 91 A 98
Wind turbine	£715	1.96 kg/m ²	A 100 A 101
Total Savings	£1039	2.89 kg/m ²	

Potential energy efficiency rating: A 100
Potential environmental impact rating: A 101

Fuel prices for cost data on this page from database revision number 567 TEST (07 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1028	Potential £1028	Saving £0
Electricity			
Space heating	£549	£549	£0
Water heating	£355	£355	£0
Lighting	£124	£124	£0
Generated (PV)	-£0	-£324	£324
Generated (wind)	-£0	-£715	£715
Total cost of fuels	£1028	-£11	£1039
Total cost of uses	£1028	-£11	£1039
Delivered energy	16 kWh/m ²	-6 kWh/m ²	21 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	-0.2 tonnes	0.7 tonnes
CO ₂ emissions per m ²	2 kg/m ²	-1 kg/m ²	3 kg/m ²
Primary energy	24 kWh/m ²	-1 kWh/m ²	25 kWh/m ²

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

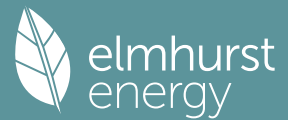
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (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)

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 4.0000 (17)
Infiltration rate 0.2000 (18)
Number of sides sheltered 0 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350	(22b)
Balanced mechanical ventilation with heat recovery													
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	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.0464 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	24.1300	0.2200	5.3086
E2 Other lintels (including other steel lintels)	23.1300	0.0120	0.2776
E3 Sill	41.4000	0.0100	0.4140
E4 Jamb	40.4000	0.0650	2.6260
E5 Ground floor (normal)	24.8000	0.0360	0.8928
E10 Eaves (insulation at ceiling level)	15.6000	0.0550	0.8580
E12 Gable (insulation at ceiling level)	14.7600	0.0540	0.7970
E16 Corner (normal)	4.9200	-0.0990	-0.4871
E17 Corner (inverted - internal area greater than external area)	40.4000	0.0700	2.8280
E6 Intermediate floor within a dwelling			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5149 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 101.4660 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014	(38)
Heat transfer coeff	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674	(39)
Average = Sum(39)m / 12 =												162.9403	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560	(40)
HLP (average)												0.6429	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0714 (42)

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

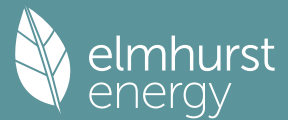
Hot water usage for baths 87.3557 86.0583 84.2314 80.8628 78.3405 75.5436 74.0329 75.8470 77.8223 80.8151 84.2530 87.0603 (42b)

Hot water usage for other uses 46.0842 44.4084 42.7326 41.0569 39.3811 37.7053 37.7053 39.3811 41.0569 42.7326 44.4084 46.0842 (42c)

Average daily hot water use (litres/day) 122.8872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7195	
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume												200.0000	(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	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

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PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
Total per year (kWh/year) = Sum(64)m =													2629.9755 (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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					2.8800	10.6334		0.6300	0.7000		0.7700		9.3591 (74)	
East					10.9200	19.6403		0.6300	0.7000		0.7700		65.5453 (76)	
West					12.0600	19.6403		0.6300	0.7000		0.7700		72.3880 (80)	
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)		
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908	
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394	
util living area	0.9807	0.9692	0.9415	0.8723	0.7506	0.5746	0.4311	0.4795	0.7174	0.9107	0.9694	0.9836	(86)
Living	19.6159	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.6104	
Non living	18.6894	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.6931	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2920	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.8048	(87)
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798	(88)
util rest of house	0.9783	0.9653	0.9341	0.8564	0.7211	0.5304	0.3769	0.4236	0.6760	0.8962	0.9650	0.9815	(89)
MIT 2	19.6973	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.9971	(90)
Living area fraction	fLA = Living area / (4) =												0.0833 (91)
MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(92)
Temperature adjustment													0.0000
adjusted MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(93)

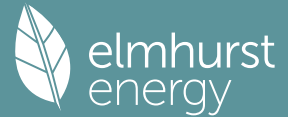
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1079.7918	1187.2401	1285.9053	1313.4174	1180.4379	857.0932	581.1780	603.9103	872.9105	1017.7415	1013.4936	1028.4185	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2631.5571	2385.5042	2163.4446	1783.6387	1369.3333	898.1449	589.3891	616.6007	977.3758	1494.7530	1993.7812	2471.4619	(97)
Space heating kWh	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98a)
Space heating requirement - total per year (kWh/year)													5226.0615
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	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5226.0615
Space heating per m2													20.6205 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													337.3809 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243 (98)
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809 (210)
Space heating fuel (main heating system)	342.1988	238.6719	193.5169	100.3493	41.6556	0.0000	0.0000	0.0000	0.0000	105.1916	209.2018	318.2232 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751 (216)
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-40.4427	-61.6202	-95.3693	-113.9863	-127.9125	-119.6425	-118.2166	-108.2825	-91.4896	-72.6422	-45.7125	-34.3337 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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	-9.6438	-21.9597	-46.9770	-76.7858	-107.7703	-112.0713	-110.4349	-91.4914	-64.9735	-34.2036	-13.6973	-7.5801 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (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												1549.0091 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9751
Water heating fuel used												1362.8573 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)
Electricity for lighting (calculated in Appendix L)												476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1727.2394 (233)
Wind generation												-3575.5408 (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												-1225.2869 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1549.0091	16.4900	255.4316 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8573	16.4900	224.7352 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	16.4900	113.5844 (249)
Energy for lighting	476.8188	16.4900	78.6274 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1029.6507	16.4900	-169.7894
PV Unit electricity exported	-697.5887	5.5900	-38.9952
Total			-208.7846 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			-9.0925 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		-0.0110 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	100.1778
SAP rating (Section 12)		100 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1549.0091	0.1557	241.1884 (261)
Total CO2 associated with community systems			0.0000 (373)

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Water heating (other fuel)	1362.8573	0.1409	192.0387 (264)
Space and water heating			433.2271 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1029.6507	0.1334	-137.3742
PV Unit electricity exported	-697.5887	0.1235	-86.1577
Total			-223.5319 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO ₂ , kg/year			-121.9106 (272)
CO ₂ emissions per m ²			-0.4800 (273)
EI value			100.5474
EI rating			101 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)

2. Ventilation rate

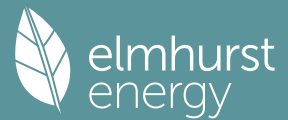
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Adj infilt rate	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
Balanced mechanical ventilation with heat recovery	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.2357	31.9563		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.9511		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.0464 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086	
E3 Sill				23.1300	0.0120	0.2776	
E4 Jamb				41.4000	0.0100	0.4140	
E5 Ground floor (normal)				40.4000	0.0650	2.6260	

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E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	101.4660 (37)

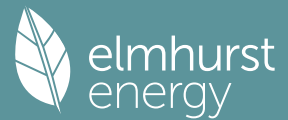
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	63.7777	62.7540	62.7540	57.6354	56.6117	52.5168	52.5168	52.5168	54.5642	57.6354	57.6354	59.6828
Average = Sum(39)m / 12 =	165.2437	164.2200	164.2200	159.1014	158.0777	153.9828	153.9828	153.9828	156.0302	159.1014	159.1014	161.1488
												159.0161
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6520	0.6480	0.6480	0.6278	0.6237	0.6076	0.6076	0.6076	0.6156	0.6278	0.6278	0.6358
Days in month	31	28	31	30	31	30	31	31	30	31	30	31
												0.6274
												0.6274

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.0714 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												87.3557 (42b)
Hot water usage for other uses												46.0842 (42c)
Average daily hot water use (litres/day)												122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446
Distribution loss (46)m = 0.15 x (45)m	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722
Water storage loss:												2040.7195
Store volume												200.0000 (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 (56)
If cylinder contains dedicated solar storage												26.7840 (57)
Primary loss												23.2624 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												261.3826 (62)
WWHRS												0.0000 (63a)
PV diverter												-0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h												261.3826 (64)
Electric shower(s)												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												110.3064 (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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015
Pumps, fans	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561
Total internal gains	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814
	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853

6. Solar gains												
[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		2.8800	12.0246	0.6300	0.7000	0.7700	10.5837 (74)					
East		10.9200	22.3829	0.6300	0.7000	0.7700	74.6984 (76)					
West		12.0600	22.3829	0.6300	0.7000	0.7700	82.4966 (80)					
Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145	775.9702	605.8185	373.5601	208.7025	136.7391 (83)
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810	1505.9578	1367.3018	1188.9618	1087.1327	1069.3244 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.3454	41.6031	41.6031	42.9416	43.2197	44.3690	44.3690	44.3690	43.7868	42.9416	42.9416	42.3960
alpha	3.7564	3.7735	3.7735	3.8628	3.8813	3.9579	3.9579	3.9579	3.9191	3.8628	3.8628	3.8264
util living area	0.9788	0.9674	0.9357	0.8535	0.7130	0.5014	0.3474	0.3829	0.6573	0.8917	0.9647	0.9822 (86)
Living	19.6959	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.6879
Non living	18.8047	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	18.8053
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3329	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.8714 (87)
Th 2	20.3834	20.3870	20.3870	20.4051	20.4087	20.4232	20.4232	20.4232	20.4159	20.4051	20.4051	20.3978 (88)
util rest of house	0.9762	0.9634	0.9276	0.8359	0.6810	0.4565	0.2946	0.3268	0.6120	0.8745	0.9596	0.9799 (89)
MIT 2	19.7540	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	19.0923 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9733	0.9526	0.9129	0.8201	0.6697	0.4508	0.2897	0.3215	0.6022	0.8580	0.9485	0.9741 (94)
Useful gains	1097.2760	1196.6763	1290.3696	1308.5751	1128.4313	772.5624	470.2103	484.1128	823.4280	1020.1202	1031.1061	1041.6774 (95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000 (96)
Heat loss rate W	2545.1267	2327.9149	2093.6321	1706.2049	1266.6156	793.2148	472.7560	487.9387	888.7845	1418.5768	1918.7896	2394.2177 (97)
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98a)
Space heating requirement - total per year (kWh/year)												4765.9969
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4765.9969
Space heating per m2										(98c) / (4) =		18.8052 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												336.5767 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98)
Space heating efficiency (main heating system 1)	336.5767	336.5767	336.5767	336.5767	336.5767	0.0000	0.0000	0.0000	0.0000	336.5767	336.5767	336.5767 (210)
Space heating fuel (main heating system)	320.0462	225.8601	177.5605	85.0604	30.5455	0.0000	0.0000	0.0000	0.0000	88.0785	189.8920	298.9779 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465 (216)
Fuel for water heating, kWh/month	135.3987	119.6531	127.0084	111.5451	108.0165	97.2225	95.9271	99.8323	101.0233	112.7705	120.0404	133.9152 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (221)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.8280	-63.1343	-96.6933	-116.5655	-128.6074	-125.9181	-123.1789	-113.8297	-97.0833	-77.0234	-50.4059	-37.7699 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732 (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)	-11.5739	-23.1208	-48.8284	-81.6352	-110.8410	-124.6026	-120.2381	-101.1557	-72.8279	-38.6636	-16.3885	-8.9628 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028 (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												1416.0212 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.0465
Water heating fuel used												1362.3530 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)

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Electricity for lighting (calculated in Appendix L)	476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1833.8762 (233)
Wind generation	-3575.5408 (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	-1465.4159 (238)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1416.0212	26.0600	369.0151 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	26.0600	355.0292 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1075.0377	26.0600	-280.1548
PV Unit electricity exported	-758.8384	5.8100	-44.0885
Total			-324.2433 (252)
Wind Turbine electricity used in dwelling	-2502.8785	26.0600	-652.2501
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-714.5718 (252)
Total energy cost			-11.0085 (255)

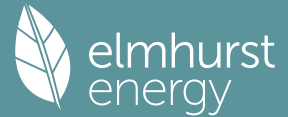
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1416.0212	0.1561	221.0533 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.3530	0.1409	191.9676 (264)
Space and water heating			413.0209 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1075.0377	0.1335	-143.4667
PV Unit electricity exported	-758.8384	0.1233	-93.5543
Total			-237.0210 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			-155.6058 (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	1416.0212	1.5779	2234.3701 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	1.5210	2072.1801 (278)
Space and water heating			4306.5502 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1075.0377	1.4931	-1605.1908
PV Unit electricity exported	-758.8384	0.4524	-343.2663
Total			-1948.4571 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546
Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			-204.9334 (286)

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Property Reference	GREEN				Issued on Date	01/04/2025
Assessment Reference	PLOT 1		Prop Type Ref			
Property	Land between, Shangri-La & Todds Corner, Todds Green, Stevenage, Hertfordshire, SG1 2JE					
SAP Rating	91 B	DER	1.68	TER	7.19	
Environmental	98 A	% DER < TER				76.63
CO ₂ Emissions (t/year)	0.39	DFEE	32.66	TFEE	33.66	
Compliance Check	See BREL	% DFEE < TFEE				2.97
% DPER < TPER	53.18	DPER	17.65	TPER	37.70	
Assessor Details	Mr. Paul Allen				Assessor ID	8075-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

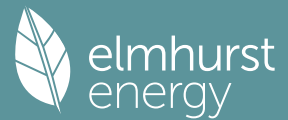
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.2357	31.9563		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.0464 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.5149 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	101.4660 (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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014	(38)
Heat transfer coeff	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674	(39)
Average = Sum(39)m / 12 =												162.9403	
HLP	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560	(40)
HLP (average)												0.6429	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)												122.8872	(43)
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7195	
Distribution loss (46)m = 0.15 x (45)m	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume												200.0000	(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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2629.9755	(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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541	(65)

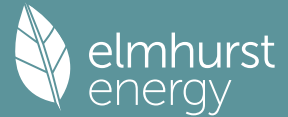
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	879.9098	907.7958	866.0566	840.6850	796.8563	770.7495	740.2254	739.2428	762.2488	784.7169	832.0178	860.1263	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.8800	10.6334	0.6300	0.7000	0.7700	9.3591 (74)
East	10.9200	19.6403	0.6300	0.7000	0.7700	65.5453 (76)
West	12.0600	19.6403	0.6300	0.7000	0.7700	72.3880 (80)

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Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	1027.2022	1195.5084	1340.8153	1537.5848	1656.8670	1654.2046	1580.0144	1456.2966	1315.6067	1126.1799	1015.5502	981.3582 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394
util living area	0.9847	0.9726	0.9479	0.8772	0.7533	0.5702	0.4274	0.4767	0.7171	0.9167	0.9733	0.9869 (86)
Living	19.5612	19.7591	20.0496	20.4506	20.7241	20.8741	20.9090	20.9035	20.8039	20.4289	19.9520	19.5599
Non living	18.6198	18.8743	19.2450	19.7582	20.0879	20.2695	20.3025	20.3020	20.1923	19.7408	19.1349	18.6287
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2640	19.7591	20.0496	20.4506	20.7241	20.8741	20.9090	20.9035	20.8039	20.4289	19.9520	19.7613 (87)
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798 (88)
util rest of house	0.9828	0.9691	0.9412	0.8618	0.7239	0.5261	0.3736	0.4211	0.6758	0.9029	0.9694	0.9852 (89)
MIT 2	19.6695	18.8743	19.2450	19.7582	20.0879	20.2695	20.3025	20.3020	20.1923	19.7408	19.1349	18.9443 (90)
Living area fraction										FLA = Living area / (4) =		0.0833 (91)
MIT	19.7191	18.9480	19.3120	19.8159	20.1409	20.3199	20.3530	20.3521	20.2433	19.7982	19.2030	19.0124 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7191	18.9480	19.3120	19.8159	20.1409	20.3199	20.3530	20.3521	20.2433	19.7982	19.2030	19.0124 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9804	0.9591	0.9272	0.8452	0.7107	0.5189	0.3680	0.4149	0.6636	0.8867	0.9596	0.9805 (94)
Useful gains	1007.0794	1146.6053	1243.2310	1299.5348	1177.4754	858.3766	581.4695	604.2104	873.0763	998.5368	974.4731	962.1984 (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	2626.8293	2378.8679	2156.4544	1781.4342	1368.8820	898.3287	589.4313	616.6439	977.4006	1491.6898	1987.5481	2462.8145 (97)
Space heating kWh	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98a)
Space heating requirement - total per year (kWh/year)												5414.7648
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	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5414.7648
Space heating per m2										(98c) / (4) =		21.3651 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												337.3809 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1205.0939	828.0804	679.4382	346.9676	142.4065	0.0000	0.0000	0.0000	0.0000	366.9059	729.4140	1116.4583 (98)
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809 (210)
Space heating fuel (main heating system)	357.1909	245.4437	201.3861	102.8415	42.2094	0.0000	0.0000	0.0000	0.0000	108.7512	216.1989	330.9192 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater (217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751 (216)
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.2890	-64.3666	-106.9283	-137.9988	-164.1658	-157.9343	-155.9388	-139.0620	-112.2470	-80.5810	-46.1794	-32.9554 (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	-0.7802	-2.4973	-6.9488	-14.6188	-24.3804	-27.4367	-26.9824	-20.7572	-12.9235	-4.8957	-1.3484	-0.5756 (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												1604.9409 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9751

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Water heating fuel used	1362.8573 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)	
mechanical ventilation fans (SFP = 0.9100)	688.8080 (230a)
Total electricity for the above, kWh/year	688.8080 (231)
Electricity for lighting (calculated in Appendix L)	476.8188 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1381.7915 (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	2751.6335 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1604.9409	0.1557	249.9592 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.8573	0.1409	192.0387 (264)
Space and water heating			441.9979 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1237.6465	0.1319	-163.3008
PV Unit electricity exported	-144.1450	0.1178	-16.9847
Total			-180.2855 (269)
Total CO2, kg/year			426.0782 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6800 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1604.9409	1.5766	2530.2921 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.8573	1.5210	2072.9471 (278)
Space and water heating			4603.2392 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1237.6465	1.4875	-1840.9928
PV Unit electricity exported	-144.1450	0.4320	-62.2735
Total			-1903.2662 (283)
Total Primary energy kWh/year			4473.3623 (286)
Dwelling Primary energy Rate (DPER)			17.6500 (287)

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

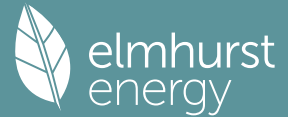
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0645 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3145 (18)
Number of sides sheltered	0 (19)

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Shelter factor (20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3145 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695	(22b)
	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			4.0600	1.0000	4.0600			(26)
TER Opening Type			25.8600	1.1450	29.6107			(27)
Heatloss Floor 1			96.7200	0.1300	12.5736			(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344			(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392			(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	88.2179		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464	(35)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	24.1300	0.0500	1.2065	
E3 Sill	23.1300	0.0500	1.1565	
E4 Jamb	41.4000	0.0500	2.0700	
E5 Ground floor (normal)	40.4000	0.1600	6.4640	
E10 Eaves (insulation at ceiling level)	24.8000	0.0600	1.4880	
E12 Gable (insulation at ceiling level)	15.6000	0.0600	0.9360	
E16 Corner (normal)	14.7600	0.0900	1.3284	
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0900	-0.4428	
E6 Intermediate floor within a dwelling	40.4000	0.0000	0.0000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.2066	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	102.4245 (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	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490	(38)
Heat transfer coeff													
	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735	(39)
Average = Sum(39)m / 12 =												217.0435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632	(40)
HLP (average)												0.8564	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

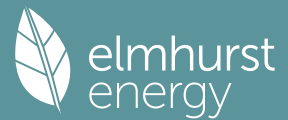
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses													
	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)													122.8872 (43)
Daily hot water use													
	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)													
													Total = Sum(45)m = 2040.7195
Distribution loss (46)m = 0.15 x (45)m													
	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6525 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8924 (55)
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983	(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													
	262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983	(64)
12Total per year (kWh/year)													
													Total per year (kWh/year) = Sum(64)m = 2640.3329 (64)
Electric shower(s)													2640 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	111.0101	98.5710	105.6246	94.9215	93.4341	85.7282	85.6741	88.1808	88.1678	96.4855	100.3745	110.0579	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	(66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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 (70)
Losses e.g. evaporation (negative values) (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	149.2072	146.6831	141.9685	131.8354	125.5834	119.0669	115.1534	118.5225	122.4553	129.6848	139.4090 (72)
Total internal gains	883.8556	911.7417	870.0025	844.6309	800.8022	771.6953	741.1713	740.1887	763.1946	788.6628	835.9637 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					2.8800	10.6334	0.6300	0.7000			0.7700	9.3591 (74)	
East					10.9200	19.6403	0.6300	0.7000			0.7700	65.5453 (76)	
West					12.0600	19.6403	0.6300	0.7000			0.7700	72.3880 (80)	
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319	(83)
Total gains	1031.1481	1199.4543	1344.7612	1541.5306	1660.8129	1655.1505	1580.9603	1457.2425	1316.5525	1130.1258	1019.4960	985.3041	(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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area	0.9854	0.9759	0.9580	0.9107	0.8236	0.6818	0.5415	0.5945	0.8003	0.9377	0.9768	0.9873 (86)
MIT	18.5679	18.8359	19.2702	19.8829	20.4096	20.7791	20.9218	20.8938	20.6063	19.9099	19.1476	18.5369 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house	0.9833	0.9725	0.9517	0.8965	0.7939	0.6263	0.4611	0.5153	0.7564	0.9251	0.9729	0.9855 (89)
MIT 2	17.2758	17.6186	18.1720	18.9482	19.5926	20.0212	20.1628	20.1416	19.8381	18.9927	18.0244	17.2412 (90)
Living area fraction	fLA = Living area / (4) = 0.0833 (91)											
MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.3835	17.7201	18.2635	19.0261	19.6607	20.0844	20.2261	20.2043	19.9021	19.0692	18.1180	17.3491 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9722	0.9571	0.9308	0.8702	0.7701	0.6162	0.4622	0.5139	0.7363	0.9010	0.9579	0.9755 (94)
Useful gains	1002.4700	1148.0306	1251.7250	1341.3764	1279.0599	1019.8347	730.7806	748.8851	969.3861	1018.2201	976.5958	961.1563 (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	2894.7741	2828.2992	2587.8381	2197.8247	1723.4597	1173.2879	775.7363	812.0522	1246.9881	1833.5383	2397.6149	2876.6834 (97)
Space heating kWh	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98a)
Space heating requirement - total per year (kWh/year)	7533.2417											
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	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	7533.2417											
Space heating per m2	(98c) / (4) = 29.7240 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.3000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1407.8743	1129.1405	994.0681	616.6428	330.6335	0.0000	0.0000	0.0000	0.0000	606.5967	1023.1337	1425.1522 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	1525.3242	1223.3375	1076.9969	668.0854	358.2161	0.0000	0.0000	0.0000	0.0000	657.2012	1108.4872	1544.0435 (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	262.2622	231.7806	246.0650	216.1852	209.4019	188.5360	186.0637	193.6025	195.8732	218.5792	232.5851	259.3983 (64)
Efficiency of water heater (217)m	87.2547	87.1265	86.8563	86.2742	85.0793	79.8000	79.8000	79.8000	79.8000	86.2241	86.9830	79.8000 (216)
Fuel for water heating, kWh/month	300.5709	266.0278	283.3012	250.5791	246.1255	236.2606	233.1625	242.6097	245.4551	253.5013	267.3916	297.1883 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)

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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	50.5346	40.5408	36.5025	26.7433	20.6573	16.8772	18.8443	24.4945	31.8159	41.7442	47.1500	51.9391	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-84.4391	-116.0247	-162.4452	-177.5451	-186.9889	-172.6716	-170.3033	-162.8427	-149.1869	-130.0603	-91.6615	-73.3413	(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	-57.1780	-119.1060	-234.7249	-349.7752	-460.0045	-461.5536	-456.3348	-387.6663	-285.7227	-169.6437	-76.0855	-45.3225	(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												8161.6920	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3122.1735	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.8434	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4780.6283	(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												6997.0807	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	8161.6920	0.2100	1713.9553	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3122.1735	0.2100	655.6564	(264)
Space and water heating			2369.6118	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	407.8434	0.1443	58.8644	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1677.5106	0.1352	-226.8003	
PV Unit electricity exported	-3103.1178	0.1261	-391.3578	
Total			-618.1581	(269)
Total CO2, kg/year			1822.2473	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.1900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	8161.6920	1.1300	9222.7120	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3122.1735	1.1300	3528.0561	(278)
Space and water heating			12750.7681	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	407.8434	1.5338	625.5639	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1677.5106	1.4997	-2515.7840	
PV Unit electricity exported	-3103.1178	0.4629	-1436.5799	
Total			-3952.3639	(283)
Total Primary energy kWh/year			9554.0689	(286)
Target Primary Energy Rate (TPER)			37.7000	(287)

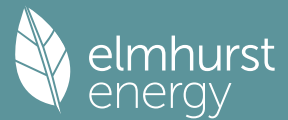
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b)	- (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c)	- (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360	(5)

2. Ventilation rate

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											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) =	0.0645 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2645 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2645 (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	0.3372	0.3306	0.3240	0.2909	0.2843	0.2512	0.2512	0.2446	0.2645	0.2843	0.2975	0.3108 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.5569	0.5546	0.5525	0.5423	0.5404	0.5316	0.5316	0.5299	0.5350	0.5404	0.5443	0.5483 (25)

3. Heat losses and heat loss parameter

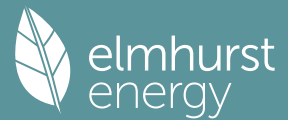
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	24595.4400		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						97.0464		(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086		
E3 Sill				23.1300	0.0120	0.2776		
E4 Jamb				41.4000	0.0100	0.4140		
E5 Ground floor (normal)				40.4000	0.0650	2.6260		
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928		
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580		
E16 Corner (normal)				14.7600	0.0540	0.7970		
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871		
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149	(36)
Point Thermal Bridges							(36a) =	0.0000
Total fabric heat loss							(33) + (36) + (36a) =	101.4660 (37)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8502	0.8484	0.8467	0.8385	0.8369	0.8298	0.8298	0.8285	0.8325	0.8369	0.8400	0.8433
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0714 (42)											
Hot water usage for mixer showers	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)											
Hot water usage for baths	32.6841 32.1987 31.5151 30.2548 29.3111 28.2646 27.6994 28.3781 29.1172 30.2369 31.5232 32.5736 (42b)											
Hot water usage for other uses	46.0842 44.4084 42.7326 41.0569 39.3811 37.7053 37.7053 39.3811 41.0569 42.7326 44.4084 46.0842 (42c)											
Average daily hot water use (litres/day)	72.1981 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317	78.6578
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786	123.1591
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month												

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WWHRS	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853 (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)	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853 (64)
Electric shower(s)												1019.1973 (64)
												1019 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												689.7407 (64a)
Heat gains from water heating, kWh/month												
	41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597	41.3305 (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	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Pumps, fans	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Total internal gains	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518 (72)
	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968 (73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North				2.8800	10.6334		0.6300		0.7000		0.7700	9.3591 (74)
East				10.9200	19.6403		0.6300		0.7000		0.7700	65.5453 (76)
West				12.0600	19.6403		0.6300		0.7000		0.7700	72.3880 (80)
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	934.9470	1104.3666	1252.2104	1455.0557	1577.9143	1579.0218	1507.3969	1381.9562	1239.1846	1045.5466	929.1144	889.9286 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	31.7066	31.7732	31.8388	32.1506	32.2096	32.4872	32.4872	32.5391	32.3797	32.2096	32.0905	31.9668
util living area	3.1138	3.1182	3.1226	3.1434	3.1473	3.1658	3.1658	3.1693	3.1586	3.1473	3.1394	3.1311
	0.9888	0.9805	0.9643	0.9199	0.8359	0.6962	0.5557	0.6117	0.8168	0.9474	0.9818	0.9904 (86)
MIT	18.5505	18.8191	19.2535	19.8655	20.3980	20.7723	20.9190	20.8887	20.5907	19.8808	19.1172	18.5115 (87)
Th 2	20.2100	20.2116	20.2131	20.2201	20.2214	20.2276	20.2276	20.2287	20.2252	20.2214	20.2188	20.2160 (88)
util rest of house	0.9872	0.9777	0.9589	0.9071	0.8077	0.6417	0.4754	0.5329	0.7753	0.9366	0.9787	0.9891 (89)
MIT 2	17.9151	18.1833	18.6152	19.2209	19.7306	20.0704	20.1848	20.1664	19.9192	19.2439	18.4863	17.8803 (90)
Living area fraction									fLA = Living area / (4) =			0.0833 (91)
MIT	17.9680	18.2362	18.6684	19.2746	19.7862	20.1289	20.2460	20.2266	19.9752	19.2970	18.5389	17.9329 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9680	18.2362	18.6684	19.2746	19.7862	20.1289	20.2460	20.2266	19.9752	19.2970	18.5389	17.9329 (93)

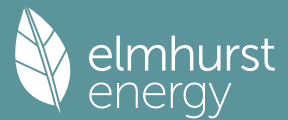
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9807	0.9680	0.9449	0.8879	0.7895	0.6341	0.4774	0.5327	0.7597	0.9198	0.9694	0.9833 (94)
Ext temp.	916.8692	1069.0236	1183.1900	1291.8804	1245.8138	1001.2700	719.6054	736.1395	941.3843	961.7417	900.6877	875.0393 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	2945.1629	2867.6408	2611.1395	2204.6305	1715.1858	1162.7310	766.7507	803.4534	1239.6519	1844.7369	2435.3391	2935.0423 (97)
Space heating requirement - total per year (kWh/year)	1509.0506	1208.6708	1062.3944	657.1801	349.2127	0.0000	0.0000	0.0000	0.0000	656.9484	1104.9490	1532.6423 (98a)
Solar heating kWh												8081.0482
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	1509.0506	1208.6708	1062.3944	657.1801	349.2127	0.0000	0.0000	0.0000	0.0000	656.9484	1104.9490	1532.6423 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8081.0482
Space heating per m2												31.8854 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1976.8217	1556.2213	1595.7305	0.0000	0.0000	0.0000	0.0000 (100)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.7025	0.7778	0.7337	0.0000	0.0000	0.0000	0.0000 (101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1388.6283	1210.3882	1170.8363	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	231.8444	313.9354	238.1521	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	57.9611	78.4839	59.5380	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												195.9830	(107)
Energy for space heating												31.8854	(99)
Energy for space cooling												0.7733	(108)
Total												32.6587	(109)
Fabric Energy Efficiency (DFEE)												32.7	(109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)	
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)	
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)	

2. Ventilation rate

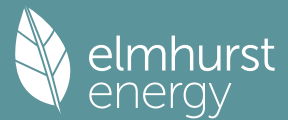
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0645 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3145	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2987	0.2987	0.2909	0.3145	0.3381	0.3538	0.3695	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			4.0600	1.0000	4.0600			(26)
TER Opening Type			25.8600	1.1450	29.6107			(27)
Heatloss Floor 1			96.7200	0.1300	12.5736			(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1800	31.3344			(29a)
External Roof 1	96.7200		96.7200	0.1100	10.6392			(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.2179			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464	(35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				24.1300	0.0500	1.2065		
E3 Sill				23.1300	0.0500	1.1565		
E4 Jamb				41.4000	0.0500	2.0700		
E5 Ground floor (normal)				40.4000	0.1600	6.4640		
E10 Eaves (insulation at ceiling level)				24.8000	0.0600	1.4880		
E12 Gable (insulation at ceiling level)				15.6000	0.0600	0.9360		
E16 Corner (normal)				14.7600	0.0900	1.3284		
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0900	-0.4428		
E6 Intermediate floor within a dwelling				40.4000	0.0000	0.0000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						14.2066		(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss						(33) + (36) + (36a) =	102.4245	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)								

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	118.8294	118.1903	117.5639	114.6217	114.0712	111.5086	111.5086	111.0341	112.4957	114.0712	115.1848	116.3490	(38)
Heat transfer coeff	221.2539	220.6148	219.9884	217.0462	216.4957	213.9331	213.9331	213.4586	214.9202	216.4957	217.6093	218.7735	(39)
Average = Sum(39)m / 12 =												217.0435	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8730	0.8705	0.8680	0.8564	0.8542	0.8441	0.8441	0.8422	0.8480	0.8542	0.8586	0.8632	(40)
HLP (average)												0.8564	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714	(42)
Hot water usage for mixer showers														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths														
32.6841	32.1987	31.5151	30.2548	29.3111	28.2646	27.6994	28.3781	29.1172	30.2369	31.5232	32.5736			(42b)
Hot water usage for other uses														
46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842			(42c)
Average daily hot water use (litres/day)													72.1981	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	78.7683	76.6071	74.2478	71.3116	68.6921	65.9699	65.4046	67.7592	70.1741	72.9696	75.9317	78.6578		(44)
Energy content (annual)	124.7498	109.0875	114.1161	97.6221	92.4728	81.1177	79.1013	83.9001	86.5316	99.0190	108.1786	123.1591		(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1199.0556		
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(46)
Water storage loss:														
Total storage loss														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(56)
If cylinder contains dedicated solar storage														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(61)
Total heat required for water heating calculated for each month														
106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853			(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	106.0373	92.7244	96.9987	82.9788	78.6019	68.9500	67.2361	71.3150	73.5519	84.1662	91.9518	104.6853		(64)
12Total per year (kWh/year)												1019.1973		(64)
Electric shower(s)	60.6369	54.0279	58.9964	56.2996	57.3560	54.7121	56.5358	57.3560	56.2996	58.9964	57.8871	60.6369		(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												689.7407		(64a)
Heat gains from water heating, kWh/month														
41.6685	36.6881	38.9988	34.8196	33.9895	30.9155	30.9430	32.1678	32.4629	35.7907	37.4597	41.3305			(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	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701	153.5701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2119	269.2703	243.2119	251.3190	243.2119	251.3190	243.2119	243.2119	251.3190	243.2119	251.3190	243.2119 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	419.3655	423.7172	412.7511	389.4054	359.9358	332.2384	313.7349	309.3832	320.3494	343.6950	373.1647	400.8620 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570	38.3570 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	56.0061	54.5954	52.4177	48.3605	45.6848	42.9382	41.5900	43.2362	45.0873	48.1057	52.0274	55.5518 (72)
Total internal gains	787.6546	816.6540	777.4517	758.1560	717.9035	695.5667	667.6079	664.9024	685.8267	704.0837	745.5821	768.6968 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.8800	10.6334	0.6300	0.7000	0.7700	9.3591 (74)			
East				10.9200	19.6403	0.6300	0.7000	0.7700	65.5453 (76)			
West				12.0600	19.6403	0.6300	0.7000	0.7700	72.3880 (80)			
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	934.9470	1104.3666	1252.2104	1455.0557	1577.9143	1579.0218	1507.3969	1381.9562	1239.1846	1045.5466	929.1144	889.9286 (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	30.8789	30.9683	31.0565	31.4775	31.5575	31.9355	31.9355	32.0065	31.7889	31.5575	31.3960	31.2289
alpha	3.0586	3.0646	3.0704	3.0985	3.1038	3.1290	3.1290	3.1338	3.1193	3.1038	3.0931	3.0819
util living area												
	0.9888	0.9806	0.9648	0.9215	0.8394	0.7014	0.5617	0.6174	0.8204	0.9482	0.9819	0.9904 (86)
MIT	18.4847	18.7563	19.1973	19.8253	20.3700	20.7597	20.9132	20.8817	20.5725	19.8475	19.0713	18.4536 (87)
Th 2	20.1905	20.1927	20.1948	20.2047	20.2066	20.2153	20.2153	20.2169	20.2119	20.2066	20.2028	20.1989 (88)
util rest of house												

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MIT 2	0.9872	0.9778	0.9594	0.9087	0.8113	0.6464	0.4800	0.5375	0.7788	0.9375	0.9788	0.9890 (89)
Living area fraction	17.8365	18.1080	18.5471	19.1707	19.6930	20.0495	20.1695	20.1508	19.8924	19.2009	18.4298	17.8111 (90)
MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8905	18.1620	18.6013	19.2253	19.7494	20.1087	20.2315	20.2117	19.9491	19.2548	18.4833	17.8646 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9805	0.9680	0.9452	0.8891	0.7925	0.6383	0.4818	0.5369	0.7626	0.9205	0.9693	0.9831	(94)
Useful gains	916.7032	1068.9724	1183.5741	1293.7186	1250.4727	1007.8247	726.2985	742.0000	945.0545	962.3842	900.6338	874.8918	(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	3006.9495	2925.7977	2662.1454	2241.0627	1742.6687	1178.4865	776.8917	813.6326	1257.0920	1873.7162	2477.1072	2989.4627	(97)
Space heating kWh	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98a)
Space heating requirement - total per year (kWh/year)												8337.6011	
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	1555.1432	1247.7866	1100.0570	682.0878	366.1939	0.0000	0.0000	0.0000	0.0000	678.0311	1135.0608	1573.2407	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8337.6011	
Space heating per m2												32.8977	(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	2010.9713	1583.1050	1622.2851	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6935	0.7693	0.7252	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1394.5270	1217.8658	1176.4606	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1710.6344	1632.3444	1490.9332	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	227.5973	308.3721	233.9676	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.8993	77.0930	58.4919	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												192.4842	(107)
Energy for space heating												32.8977	(99)
Energy for space cooling												0.7595	(108)
Total												33.6572	(109)
Fabric Energy Efficiency (TFEE)												33.7	(109)

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

CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

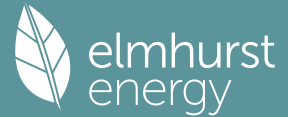
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)	
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)	
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)	

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2000 (21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												83.7000 (23c)
Effective ac	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.2357	31.9563		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m2)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)							
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						(28)...(30) + (32) + (32a)...(32e) =	24595.4400 (34)
List of Thermal Bridges							97.0464 (35)
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086	
E3 Sill				23.1300	0.0120	0.2776	
E4 Jamb				41.4000	0.0100	0.4140	
E5 Ground floor (normal)				40.4000	0.0650	2.6260	
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928	
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580	
E16 Corner (normal)				14.7600	0.0540	0.7970	
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871	
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	101.4660 (37)

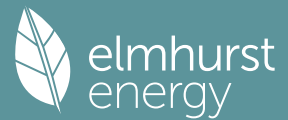
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014 (38)
Average = Sum(39)m / 12 =	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674 (39)
												162.9403
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560 (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												3.0714 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												87.3557
Hot water usage for other uses												46.0842
Average daily hot water use (litres/day)												122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446 (44)
Energy content (annual)	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722 (45)
Distribution loss (46)m = 0.15 x (45)m												2040.7195
Water storage loss:												
Store volume												200.0000 (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												
If cylinder contains dedicated solar storage												
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 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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)
Electric shower(s)												
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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)
	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541 (65)

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	(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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	(71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814	(72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.8800	10.6334		0.6300	0.7000	0.7700		9.3591 (74)	
East					10.9200	19.6403		0.6300	0.7000	0.7700		65.5453 (76)	
West					12.0600	19.6403		0.6300	0.7000	0.7700		72.3880 (80)	
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)	
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908	
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394	
util living area	0.9807	0.9692	0.9415	0.8723	0.7506	0.5746	0.4311	0.4795	0.7174	0.9107	0.9694	0.9836	(86)
Living	19.6159	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.6104	
Non living	18.6894	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.6931	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2920	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.8048	(87)
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798	(88)
util rest of house	0.9783	0.9653	0.9341	0.8564	0.7211	0.5304	0.3769	0.4236	0.6760	0.8962	0.9650	0.9815	(89)
MIT 2	19.6973	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.9971	(90)
Living area fraction									flA =	Living area / (4) =		0.0833	(91)
MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9546	0.9195	0.8399	0.7080	0.5230	0.3713	0.4173	0.6639	0.8797	0.9544	0.9759	(94)
Useful gains	1079.7918	1187.2401	1285.9053	1313.4174	1180.4379	857.0932	581.1780	603.9103	872.9105	1017.7415	1013.4936	1028.4185	(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	2631.5571	2385.5042	2163.4446	1783.6387	1369.3333	898.1449	589.3891	616.6007	977.3758	1494.7530	1993.7812	2471.4619	(97)
Space heating kWh	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98a)
Space heating requirement - total per year (kWh/year)												5226.0615	
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	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5226.0615	
Space heating per m2										(98c) / (4) =		20.6205	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													337.3809 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98)
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809	(210)
Space heating fuel (main heating system)	342.1988	238.6719	193.5169	100.3493	41.6556	0.0000	0.0000	0.0000	0.0000	105.1916	209.2018	318.2232	(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

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Water heating requirement	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater												192.9751 (216)
(217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751 (217)
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015 (231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.2789	-64.3493	-106.8727	-137.9545	-164.1475	-157.9343	-155.9388	-139.0620	-112.2470	-80.5590	-46.1692	-32.9488 (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	-0.7903	-2.5147	-7.0043	-14.6632	-24.3987	-27.4367	-26.9824	-20.7572	-12.9235	-4.9177	-1.3586	-0.5822 (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												1549.0091 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												192.9751
Water heating fuel used												1362.8573 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)												
mechanical ventilation fans (SFP = 0.9100)												688.8080 (230a)
Total electricity for the above, kWh/year												688.8080 (231)
Electricity for lighting (calculated in Appendix L)												476.8188 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1381.7915 (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												2695.7017 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1549.0091	16.4900	255.4316 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1362.8573	16.4900	224.7352 (247)	
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)	
Pumps, fans and electric keep-hot	688.8080	16.4900	113.5844 (249)	
Energy for lighting	476.8188	16.4900	78.6274 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.4620	16.4900	-204.0575	
PV Unit electricity exported	-144.3295	5.5900	-8.0680	
Total			-212.1255 (252)	
Total energy cost			460.2531 (255)	

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.5552 (257)
SAP value			91.0004
SAP rating (Section 12)			91 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1549.0091	0.1557	241.1884 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	1362.8573	0.1409	192.0387 (264)	
Space and water heating			433.2271 (265)	
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)	
Energy for lighting	476.8188	0.1443	68.8197 (268)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1237.4620	0.1319	-163.2735	
PV Unit electricity exported	-144.3295	0.1179	-17.0150	
Total			-180.2884 (269)	
Total CO2, kg/year			417.3045 (272)	
CO2 emissions per m2			1.6500 (273)	
EI value			98.1263	
EI rating			98 (274)	
EI band			A	

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 620.4360 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
Adj infilt rate	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (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	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)

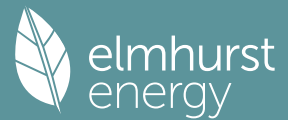
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
WINDOW			25.8600	1.2357	31.9563		(27)
DOOR			4.0600	1.5000	6.0900		(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000 (28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000 (29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800 (30)
Total net area of external elements Aum(A, m ²)			397.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511		(33)
Main dwelling							
Internal Wall 1			100.0000			9.0000	900.0000 (32c)
Internal Floor 1			96.7200			18.0000	1740.9600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							97.0464 (35)

List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086						
E3 Sill				23.1300	0.0120	0.2776						
E4 Jamb				41.4000	0.0100	0.4140						
E5 Ground floor (normal)				40.4000	0.0650	2.6260						
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928						
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580						
E16 Corner (normal)				14.7600	0.0540	0.7970						
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871						
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149					(36)
Point Thermal bridges							(36a) =					0.0000
Total fabric heat loss							(33) + (36) + (36a) =					101.4660 (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	63.7777	62.7540	62.7540	57.6354	56.6117	52.5168	52.5168	52.5168	54.5642	57.6354	57.6354	59.6828 (38)
Average = Sum(39)m / 12 =	165.2437	164.2200	164.2200	159.1014	158.0777	153.9828	153.9828	153.9828	156.0302	159.1014	159.1014	161.1488 (39)
												159.0161
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6520	0.6480	0.6480	0.6278	0.6237	0.6076	0.6076	0.6076	0.6156	0.6278	0.6278	0.6358 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0714 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603 (42b)
Hot water usage for other uses	46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842 (42c)
Average daily hot water use (litres/day)												122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446 (44)
Distribution loss (46)m = 0.15 x (45)m	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722 (45)
Water storage loss:	31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708 (46)
Store volume												200.0000 (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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814 (72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853 (73)

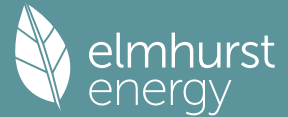
6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					2.8800	12.0246	0.6300	0.7000			0.7700	10.5837 (74)
East					10.9200	22.3829	0.6300	0.7000			0.7700	74.6984 (76)
West					12.0600	22.3829	0.6300	0.7000			0.7700	82.4966 (80)
Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145	775.9702	605.8185	373.5601	208.7025	136.7391 (83)
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810	1505.9578	1367.3018	1188.9618	1087.1327	1069.3244 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.3454	41.6031	41.6031	42.9416	43.2197	44.3690	44.3690	44.3690	43.7868	42.9416	42.9416	42.3960
alpha	3.7564	3.7735	3.7735	3.8628	3.8813	3.9579	3.9579	3.9579	3.9191	3.8628	3.8628	3.8264
util living area												
	0.9788	0.9674	0.9357	0.8535	0.7130	0.5014	0.3474	0.3829	0.6573	0.8917	0.9647	0.9822 (86)
Living	19.6959	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.6879
Non living	18.8047	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	18.8053
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3329	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.8714 (87)
Th 2	20.3834	20.3870	20.3870	20.4051	20.4087	20.4232	20.4232	20.4232	20.4159	20.4051	20.4051	20.3978 (88)
util rest of house												
	0.9762	0.9634	0.9276	0.8359	0.6810	0.4565	0.2946	0.3268	0.6120	0.8745	0.9596	0.9799 (89)
MIT 2	19.7540	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	19.0923 (90)
Living area fraction	fLA = Living area / (4) = 0.0833 (91)											
MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (92)
Temperature adjustment	0.0000											

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adjusted MIT 19.8023 19.0756 19.4489 19.9240 20.2126 20.3513 20.3702 20.3688 20.2962 19.9162 19.3602 19.1572 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9733	0.9526	0.9129	0.8201	0.6697	0.4508	0.2897	0.3215	0.6022	0.8580	0.9485	0.9741	(94)
Useful gains	1097.2760	1196.6763	1290.3696	1308.5751	1128.4313	772.5624	470.2103	484.1128	823.4280	1020.1202	1031.1061	1041.6774	(95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000	(96)
Heat loss rate W	2545.1267	2327.9149	2093.6321	1706.2049	1266.6156	793.2148	472.7560	487.9387	888.7845	1418.5768	1918.7896	2394.2177	(97)
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900	(98a)
Space heating requirement - total per year (kWh/year)												4765.9969	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4765.9969	
Space heating per m2										(98c) / (4) =		18.8052	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													336.5767	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900	(98)	
Space heating efficiency (main heating system 1)	336.5767	336.5767	336.5767	336.5767	336.5767	0.0000	0.0000	0.0000	0.0000	336.5767	336.5767	336.5767	(210)	
Space heating fuel (main heating system)	320.0462	225.8601	177.5605	85.0604	30.5455	0.0000	0.0000	0.0000	0.0000	88.0785	189.8920	298.9779	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)	
Efficiency of water heater	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	(216)	
Fuel for water heating, kWh/month	135.3987	119.6531	127.0084	111.5451	108.0165	97.2225	95.9271	99.8323	101.0233	112.7705	120.0404	133.9152	(217)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)	
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015	(221)	
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232	(231)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-44.1077	-66.2963	-108.9901	-142.4963	-166.0378	-168.6730	-164.4026	-148.1632	-120.8232	-86.6967	-51.6958	-36.6547	(232)	
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	(233a)	
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	(234a)	
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	(235a)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-1.0138	-2.7078	-7.4273	-16.0643	-25.5210	-31.7436	-30.3310	-23.8251	-15.1057	-5.8530	-1.7396	-0.7315	(235a)	
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	(235c)	
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	(234b)	
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	(235b)	
Annual totals kWh/year														
Space heating fuel - main system 1													1416.0212	(235d)
Space heating fuel - main system 2													0.0000	(211)
Space heating fuel - secondary													0.0000	(213)
Efficiency of water heater													193.0465	(215)
Water heating fuel used													1362.3530	(216)
Space cooling fuel													0.0000	(219)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)														
mechanical ventilation fans (SFP = 0.9100)													688.8080	(221)
Total electricity for the above, kWh/year													688.8080	(221)
Electricity for lighting (calculated in Appendix L)													476.8188	(230a)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1467.1009	(231)
Wind generation													0.0000	(232)
Hydro-electric generation (Appendix N)													0.0000	(233)
Electricity generated - Micro CHP (Appendix N)													0.0000	(234)
Appendix Q - special features														
Energy saved or generated													-0.0000	(235)
Energy used													0.0000	(236)
Total delivered energy for all uses													2476.9001	(237)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1416.0212	26.0600	369.0151	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1362.3530	26.0600	355.0292	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)

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Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	26.0600	-340.0927
PV Unit electricity exported	-162.0637	5.8100	-9.4159
Total			-349.5086 (252)
Total energy cost			678.2981 (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	1416.0212	0.1561	221.0533 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.3530	0.1409	191.9676 (264)
Space and water heating			413.0209 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	0.1319	-172.1621
PV Unit electricity exported	-162.0637	0.1175	-19.0415
Total			-191.2035 (269)
Total CO2, kg/year			386.1833 (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	1416.0212	1.5779	2234.3701 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	1.5210	2072.1801 (278)
Space and water heating			4306.5502 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	1.4874	-1941.1053
PV Unit electricity exported	-162.0637	0.4307	-69.8024
Total			-2010.9077 (283)
Total Primary energy kWh/year			4069.0318 (286)

SAP 10 EPC IMPROVEMENTS

PLOT 1

Current energy efficiency rating:	B 91
Current environmental impact rating:	A 98

N Solar water heating	SAP increase too small		
U Solar photovoltaic panels	Already installed		
V2 Wind turbine	Recommended		
Recommended measures:	SAP change	Cost change	CO2 change
V2 Wind turbine	+ 9.2	-£ 715	-496 kg (128.4%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 76	-37 kg (9.6%)

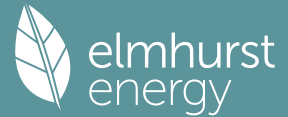
	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Wind turbine	£715	1.96 kg/m²	A 100
Total Savings	£715	1.96 kg/m²	A 100
Potential energy efficiency rating:			A 100
Potential environmental impact rating:			A 100

Fuel prices for cost data on this page from database revision number 567 TEST (07 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1028	Potential £1028	East £0	Saving
Electricity				
Space heating	£549	£549	£0	
Water heating	£355	£355	£0	
Lighting	£124	£124	£0	
Generated (PV)	-£350	-£350	£0	
Generated (wind)	-£0	-£715	£715	
Total cost of fuels	£678	-£37	£715	
Total cost of uses	£678	-£37	£715	
Delivered energy	10 kWh/m²	-4 kWh/m²	14 kWh/m²	
Carbon dioxide emissions	0.4 tonnes	-0.1 tonnes	0.5 tonnes	
CO2 emissions per m²	2 kg/m²	-0 kg/m²	2 kg/m²	
Primary energy	16 kWh/m²	-1 kWh/m²	17 kWh/m²	

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

1. Overall dwelling characteristics

Main dwelling	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)

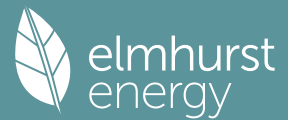
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 1.0000 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.2000 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2550	0.2500	0.2450	0.2200	0.2150	0.1900	0.1900	0.1850	0.2000	0.2150	0.2250	0.2350 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation											0.5000 (23a)	
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)											0.5000 (23b)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =											83.7000 (23c)	
Effective ac	0.3365	0.3315	0.3265	0.3015	0.2965	0.2715	0.2715	0.2665	0.2815	0.2965	0.3065	0.3165 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
WINDOW			25.8600	1.2357	31.9563			(27)					
DOOR			4.0600	1.5000	6.0900			(26)					
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)					
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)					
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)					
Total net area of external elements Aum(A, m2)			397.4400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		87.9511			(33)					
Main dwelling													
Internal Wall 1			100.0000			9.0000	900.0000	(32c)					
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24595.4400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							97.0464	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E2 Other lintels (including other steel lintels)				24.1300	0.2200	5.3086							
E3 Sill				23.1300	0.0120	0.2776							
E4 Jamb				41.4000	0.0100	0.4140							
E5 Ground floor (normal)				40.4000	0.0650	2.6260							
E10 Eaves (insulation at ceiling level)				24.8000	0.0360	0.8928							
E12 Gable (insulation at ceiling level)				15.6000	0.0550	0.8580							
E16 Corner (normal)				14.7600	0.0540	0.7970							
E17 Corner (inverted - internal area greater than external area)				4.9200	-0.0990	-0.4871							
E6 Intermediate floor within a dwelling				40.4000	0.0700	2.8280							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.5149	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	101.4660	(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	68.8963	67.8726	66.8489	61.7303	60.7066	55.5880	55.5880	54.5642	57.6354	60.7066	62.7540	64.8014	(38)
Average = Sum(39)m / 12 =	170.3623	169.3386	168.3149	163.1963	162.1726	157.0540	157.0540	156.0302	159.1014	162.1726	164.2200	166.2674	(39)
												162.9403	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.6722	0.6682	0.6641	0.6439	0.6399	0.6197	0.6197	0.6156	0.6278	0.6399	0.6480	0.6560	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0714 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	(42b)
Hot water usage for other uses												
46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	(42c)
Average daily hot water use (litres/day)												122.8872 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy content	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2040.7195
31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	(46)
Water storage loss:												
Store volume												200.0000 (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	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (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	110.3064	97.9354	104.9208	94.2405	92.7303	85.0471	84.9704	87.4770	87.4867	95.7818	99.6935	109.3541 (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	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814 (72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853 (73)

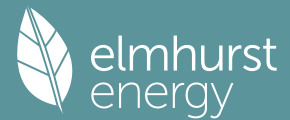
6. Solar gains

[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					2.8800	10.6334	0.6300	0.7000	0.7700			9.3591 (74)
East					10.9200	19.6403	0.6300	0.7000	0.7700			65.5453 (76)
West					12.0600	19.6403	0.6300	0.7000	0.7700			72.3880 (80)
Solar gains	147.2925	287.7126	474.7587	696.8997	860.0108	883.4551	839.7890	717.0538	553.3579	341.4630	183.5323	121.2319 (83)
Total gains	1106.8989	1243.7431	1398.5115	1563.8307	1667.3855	1638.6764	1565.3555	1447.0413	1314.8412	1156.8647	1061.9625	1053.8172 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.1032	40.3456	40.5910	41.8641	42.1284	43.5014	43.5014	43.7868	42.9416	42.1284	41.6031	41.0908
alpha	3.6735	3.6897	3.7061	3.7909	3.8086	3.9001	3.9001	3.9191	3.8628	3.8086	3.7735	3.7394
util living area												
	0.9807	0.9692	0.9415	0.8723	0.7506	0.5746	0.4311	0.4795	0.7174	0.9107	0.9694	0.9836 (86)
Living	19.6159	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.6104
Non living	18.6894	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.6931
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2920	19.7907	20.0835	20.4620	20.7267	20.8728	20.9086	20.9031	20.8037	20.4447	19.9826	19.8048 (87)
Th 2	20.3655	20.3690	20.3726	20.3906	20.3942	20.4123	20.4123	20.4159	20.4051	20.3942	20.3870	20.3798 (88)
util rest of house												
	0.9783	0.9653	0.9341	0.8564	0.7211	0.5304	0.3769	0.4236	0.6760	0.8962	0.9650	0.9815 (89)
MIT 2	19.6973	18.9141	19.2872	19.7719	20.0907	20.2683	20.3022	20.3017	20.1921	19.7600	19.1735	18.9971 (90)
Living area fraction									fLA = Living area / (4) =			0.0833 (91)
MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7468	18.9872	19.3536	19.8294	20.1437	20.3187	20.3528	20.3518	20.2431	19.8171	19.2409	19.0644 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9546	0.9195	0.8399	0.7080	0.5230	0.3713	0.4173	0.6639	0.8797	0.9544	0.9759	(94)
Useful gains	1079.7918	1187.2401	1285.9053	1313.4174	1180.4379	857.0932	581.1780	603.9103	872.9105	1017.7415	1013.4936	1028.4185	(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	2631.5571	2385.5042	2163.4446	1783.6387	1369.3333	898.1449	589.3891	616.6007	977.3758	1494.7530	1993.7812	2471.4619	(97)
Space heating kWh	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98a)
Space heating requirement - total per year (kWh/year)												5226.0615	
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	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5226.0615	
Space heating per m2												20.6205	(99)

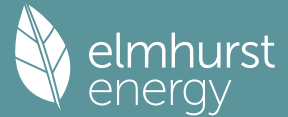
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													337.3809	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1154.5134	805.2334	652.8893	338.5594	140.5382	0.0000	0.0000	0.0000	0.0000	354.8965	705.8071	1073.6243	(98)	
Space heating efficiency (main heating system 1)	337.3809	337.3809	337.3809	337.3809	337.3809	0.0000	0.0000	0.0000	0.0000	337.3809	337.3809	337.3809	(210)	
Space heating fuel (main heating system)	342.1988	238.6719	193.5169	100.3493	41.6556	0.0000	0.0000	0.0000	0.0000	105.1916	209.2018	318.2232	(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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	(64)	
Efficiency of water heater	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	(216)	
(217)m	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	192.9751	(217)	
Fuel for water heating, kWh/month	135.4488	119.6974	127.0554	111.5864	108.0565	97.2585	95.9626	99.8693	101.0607	112.8122	120.0848	133.9647	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015	(231)	
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-39.2789	-64.3493	-106.8727	-137.9545	-164.1475	-157.9343	-155.9388	-139.0620	-112.2470	-80.5590	-46.1692	-32.9488	(233a)	
(233a)m	-39.2789	-64.3493	-106.8727	-137.9545	-164.1475	-157.9343	-155.9388	-139.0620	-112.2470	-80.5590	-46.1692	-32.9488	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(234a)	
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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)	
(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)	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)	
(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)	-0.7903	-2.5147	-7.0043	-14.6632	-24.3987	-27.4367	-26.9824	-20.7572	-12.9235	-4.9177	-1.3586	-0.5822	(233b)	
(233b)m	-0.7903	-2.5147	-7.0043	-14.6632	-24.3987	-27.4367	-26.9824	-20.7572	-12.9235	-4.9177	-1.3586	-0.5822	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(234b)	
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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)	
(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)	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)	
(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													1549.0091	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													192.9751	
Water heating fuel used													1362.8573	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)														
mechanical ventilation fans (SFP = 0.9100)													688.8080	(230a)
Total electricity for the above, kWh/year													688.8080	(231)
Electricity for lighting (calculated in Appendix L)													476.8188	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1381.7915	(233)
Wind generation													-3575.5408	(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													-879.8390	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1549.0091	16.4900	255.4316	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1362.8573	16.4900	224.7352	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	688.8080	16.4900	113.5844	(249)

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Energy for lighting	476.8188	16.4900	78.6274 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1237.4620	16.4900	-204.0575
PV Unit electricity exported	-144.3295	5.5900	-8.0680
Total			-212.1255 (252)
Wind Turbine electricity used in dwelling	-2502.8785	16.4900	-412.7247
Wind Turbine electricity exported	-1072.6622	5.5900	-59.9618
Total			-472.6865 (252)
Total energy cost			-12.4334 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		-0.0150 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	100.2431
SAP rating (Section 12)		100 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1549.0091	0.1557	241.1884 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.8573	0.1409	192.0387 (264)
Space and water heating			433.2271 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1237.4620	0.1319	-163.2735
PV Unit electricity exported	-144.3295	0.1179	-17.0150
Total			-180.2884 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			-78.6671 (272)
CO2 emissions per m2			-0.3100 (273)
EI value			100.3532
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

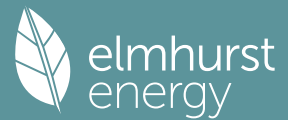
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	96.7200 (1b)	x 2.4000 (2b)	= 232.1280 (1b) - (3b)
First floor	96.7200 (1c)	x 2.6500 (2c)	= 256.3080 (1c) - (3c)
Second floor	60.0000 (1d)	x 2.2000 (2d)	= 132.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	253.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	620.4360 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2000 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.0000	3.9000	3.5000	3.5000	3.5000	3.7000	4.0000	4.0000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0000	0.9750	0.8750	0.8750	0.8750	0.9250	1.0000	1.0000	1.0500 (22a)
Adj infilt rate	0.2300	0.2250	0.2250	0.2000	0.1950	0.1750	0.1750	0.1750	0.1850	0.2000	0.2000	0.2100 (22b)
Balanced mechanical ventilation with heat recovery												

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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	0.3115	0.3065	0.3065	0.2815	0.2765	0.2565	0.2565	0.2565	0.2665	0.2815	0.2815	0.2915 (25)
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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
WINDOW			25.8600	1.2357	31.9563			(27)
DOOR			4.0600	1.5000	6.0900			(26)
Heatloss Floor 1			96.7200	0.1200	11.6064	110.0000	10639.2000	(28a)
EXP WALL	204.0000	29.9200	174.0800	0.1700	29.5936	60.0000	10444.8000	(29a)
External Roof 1	96.7200		96.7200	0.0900	8.7048	9.0000	870.4800	(30)
Total net area of external elements Aum(A, m2)			397.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.9511			(33)
Main dwelling								
Internal Wall 1			100.0000			9.0000	900.0000	(32c)
Internal Floor 1			96.7200			18.0000	1740.9600	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24595.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 97.0464 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	24.1300	0.2200	5.3086
E3 Sill	23.1300	0.0120	0.2776
E4 Jamb	41.4000	0.0100	0.4140
E5 Ground floor (normal)	40.4000	0.0650	2.6260
E10 Eaves (insulation at ceiling level)	24.8000	0.0360	0.8928
E12 Gable (insulation at ceiling level)	15.6000	0.0550	0.8580
E16 Corner (normal)	14.7600	0.0540	0.7970
E17 Corner (inverted - internal area greater than external area)	4.9200	-0.0990	-0.4871
E6 Intermediate floor within a dwelling	40.4000	0.0700	2.8280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5149 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 101.4660 (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	
(38)m	63.7777	62.7540	62.7540	57.6354	56.6117	52.5168	52.5168	52.5168	54.5642	57.6354	57.6354	59.6828	(38)
Heat transfer coeff	165.2437	164.2200	164.2200	159.1014	158.0777	153.9828	153.9828	153.9828	156.0302	159.1014	159.1014	161.1488	(39)
Average = Sum(39)m / 12 =												159.0161	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6520	0.6480	0.6480	0.6278	0.6237	0.6076	0.6076	0.6076	0.6156	0.6278	0.6278	0.6358	(40)
HLP (average)												0.6274	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0714 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
87.3557	86.0583	84.2314	80.8628	78.3405	75.5436	74.0329	75.8470	77.8223	80.8151	84.2530	87.0603	87.0603	(42b)
Hot water usage for other uses													
46.0842	44.4084	42.7326	41.0569	39.3811	37.7053	37.7053	39.3811	41.0569	42.7326	44.4084	46.0842	46.0842	(42c)
Average daily hot water use (litres/day)												122.8872	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.4399	130.4667	126.9640	121.9197	117.7215	113.2489	111.7381	115.2281	118.8792	123.5477	128.6614	133.1446	(44)
Energy conte	211.3362	185.7829	195.1390	166.9019	158.4758	139.2527	135.1376	142.6764	146.5899	167.6531	183.3018	208.4722	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7195	
Distribution loss (46)m = 0.15 x (45)m													
31.7004	27.8674	29.2708	25.0353	23.7714	20.8879	20.2706	21.4015	21.9885	25.1480	27.4953	31.2708	31.2708	(46)

Water storage loss:

Store volume													200.0000 (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	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	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186	258.5186	(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 261.3826 230.9861 245.1854 215.3339 208.5222 187.6847 185.1840 192.7228 195.0219 217.6995 231.7338 258.5186 (64)
Total per year (kWh/year) = Sum(64)m = 2629.9755 (64)

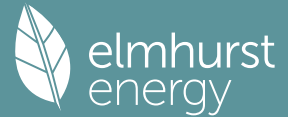
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month 110.3064 97.9354 104.9208 94.2405 92.7303 85.0471 84.9704 87.4770 87.4867 95.7818 99.6935 109.3541 (65)

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

Metabolic gains (Table 5), Watts													
(66)m	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	184.2841	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
67.4986	59.9517	48.7560	36.9114	27.5917	23.2941	25.1701	32.7170	43.9127	55.7573	65.0770	69.3746	69.3746	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.9187	632.4138	616.0464	581.2022	537.2176	495.8783	468.2611	461.7660	478.1334	512.9776	556.9622	598.3015 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998	56.4998 (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)	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561	-122.8561 (71)
Water heating gains (Table 5)	148.2613	145.7372	141.0226	130.8896	124.6375	118.1210	114.2075	117.5767	121.5094	128.7389	138.4631	146.9814 (72)
Total internal gains	959.6065	956.0305	923.7528	866.9310	807.3747	755.2212	725.5665	729.9876	761.4834	815.4017	878.4302	932.5853 (73)

6. Solar gains

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

North					2.8800	12.0246	0.6300	0.7000			0.7700	10.5837 (74)	
East					10.9200	22.3829	0.6300	0.7000			0.7700	74.6984 (76)	
West					12.0600	22.3829	0.6300	0.7000			0.7700	82.4966 (80)	

Solar gains	167.7788	300.1682	489.7977	728.7634	877.6185	958.5237	897.5145	775.9702	605.8185	373.5601	208.7025	136.7391 (83)	
Total gains	1127.3852	1256.1987	1413.5505	1595.6944	1684.9932	1713.7450	1623.0810	1505.9578	1367.3018	1188.9618	1087.1327	1069.3244 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.3454	41.6031	41.6031	42.9416	43.2197	44.3690	44.3690	44.3690	43.7868	42.9416	42.9416	42.3960
alpha	3.7564	3.7735	3.7735	3.8628	3.8813	3.9579	3.9579	3.9579	3.9191	3.8628	3.8628	3.8264
util living area	0.9788	0.9674	0.9357	0.8535	0.7130	0.5014	0.3474	0.3829	0.6573	0.8917	0.9647	0.9822 (86)
Living	19.6959	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.6879
Non living	18.8047	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	18.8053
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3329	19.8516	20.1525	20.5319	20.7773	20.8964	20.9175	20.9155	20.8456	20.5204	20.0684	19.8714 (87)
Th 2	20.3834	20.3870	20.3870	20.4051	20.4087	20.4232	20.4232	20.4232	20.4159	20.4051	20.4051	20.3978 (88)
util rest of house	0.9762	0.9634	0.9276	0.8359	0.6810	0.4565	0.2946	0.3268	0.6120	0.8745	0.9596	0.9799 (89)
MIT 2	19.7540	19.0050	19.3850	19.8688	20.1613	20.3018	20.3204	20.3191	20.2463	19.8613	19.2958	19.0923 (90)
Living area fraction									fLA = Living area / (4) =			0.0833 (91)
MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8023	19.0756	19.4489	19.9240	20.2126	20.3513	20.3702	20.3688	20.2962	19.9162	19.3602	19.1572 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9733	0.9526	0.9129	0.8201	0.6697	0.4508	0.2897	0.3215	0.6022	0.8580	0.9485	0.9741 (94)
Useful gains	1097.2760	1196.6763	1290.3696	1308.5751	1128.4313	772.5624	470.2103	484.1128	823.4280	1020.1202	1031.1061	1041.6774 (95)
Ext temp.	4.4000	4.9000	6.7000	9.2000	12.2000	15.2000	17.3000	17.2000	14.6000	11.0000	7.3000	4.3000 (96)
Heat loss rate W	2545.1267	2327.9149	2093.6321	1706.2049	1266.6156	793.2148	472.7560	487.9387	888.7845	1418.5768	1918.7896	2394.2177 (97)
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98a)
Space heating requirement - total per year (kWh/year)												4765.9969
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4765.9969
Space heating per m2										(98c) / (4) =		18.8052 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												336.5767 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1077.2009	760.1924	597.6273	286.2934	102.8091	0.0000	0.0000	0.0000	0.0000	296.4517	639.1321	1006.2900 (98)
Space heating efficiency (main heating system 1)	336.5767	336.5767	336.5767	336.5767	336.5767	0.0000	0.0000	0.0000	0.0000	336.5767	336.5767	336.5767 (210)
Space heating fuel (main heating system)	320.0462	225.8601	177.5605	85.0604	30.5455	0.0000	0.0000	0.0000	0.0000	88.0785	189.8920	298.9779 (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	261.3826	230.9861	245.1854	215.3339	208.5222	187.6847	185.1840	192.7228	195.0219	217.6995	231.7338	258.5186 (64)
Efficiency of water heater	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465	193.0465 (216)
Fuel for water heating, kWh/month												193.0465 (217)

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	135.3987	119.6531	127.0084	111.5451	108.0165	97.2225	95.9271	99.8323	101.0233	112.7705	120.0404	133.9152	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	58.5015	52.8401	58.5015	56.6144	58.5015	56.6144	58.5015	58.5015	56.6144	58.5015	56.6144	58.5015	(231)
Lighting	59.0812	47.3971	42.6758	31.2661	24.1509	19.7315	22.0312	28.6370	37.1967	48.8040	55.1240	60.7232	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.1077	-66.2963	-108.9901	-142.4963	-166.0378	-168.6730	-164.4026	-148.1632	-120.8232	-86.6967	-51.6958	-36.6547	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	-212.5732	-192.0016	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	-212.5732	-205.7160	-212.5732	-205.7160	-212.5732	(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	-1.0138	-2.7078	-7.4273	-16.0643	-25.5210	-31.7436	-30.3310	-23.8251	-15.1057	-5.8530	-1.7396	-0.7315	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	-91.1028	-82.2864	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	-91.1028	-88.1640	-91.1028	-88.1640	-91.1028	(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												1416.0212	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												193.0465	
Water heating fuel used												1362.3530	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9100)													
mechanical ventilation fans (SFP = 0.9100)												688.8080	(230a)
Total electricity for the above, kWh/year												688.8080	(231)
Electricity for lighting (calculated in Appendix L)												476.8188	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1467.1009	(233)
Wind generation												-3575.5408	(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												-1098.6407	(238)

10a. Fuel costs - using BEDF prices (567)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1416.0212	26.0600	369.0151 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	26.0600	355.0292 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	688.8080	26.0600	179.5034 (249)
Energy for lighting	476.8188	26.0600	124.2590 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	26.0600	-340.0927
PV Unit electricity exported	-162.0637	5.8100	-9.4159
Total			-349.5086 (252)
Wind Turbine electricity used in dwelling	-2502.8785	26.0600	-652.2501
Wind Turbine electricity exported	-1072.6622	5.8100	-62.3217
Total			-714.5718 (252)
Total energy cost			-36.2738 (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	1416.0212	0.1561	221.0533 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1362.3530	0.1409	191.9676 (264)
Space and water heating			413.0209 (265)
Pumps, fans and electric keep-hot	688.8080	0.1387	95.5462 (267)
Energy for lighting	476.8188	0.1443	68.8197 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	0.1319	-172.1621
PV Unit electricity exported	-162.0637	0.1175	-19.0415
Total			-191.2035 (269)
Wind Turbine electricity used in dwelling	-2502.8785	0.1387	-347.1801
Wind Turbine electricity exported	-1072.6622	0.1387	-148.7915
Total			-495.9716 (269)
Total CO2, kg/year			-109.7883 (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	1416.0212	1.5779	2234.3701 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1362.3530	1.5210	2072.1801 (278)
Space and water heating			4306.5502 (279)
Pumps, fans and electric keep-hot	688.8080	1.5128	1042.0288 (281)
Energy for lighting	476.8188	1.5338	731.3605 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1305.0373	1.4874	-1941.1053
PV Unit electricity exported	-162.0637	0.4307	-69.8024
Total			-2010.9077 (283)
Wind Turbine electricity used in dwelling	-2502.8785	1.5128	-3786.3546

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Wind Turbine electricity exported	-1072.6622	0.5128	-550.0612
Total			-4336.4158 (283)
Total Primary energy kWh/year			-267.3840 (286)

Predicted Energy Assessment



Land between, Shangri-La & Todds Corner, Todds Green, Stevenage, Hertfordshire, SG1 2JE

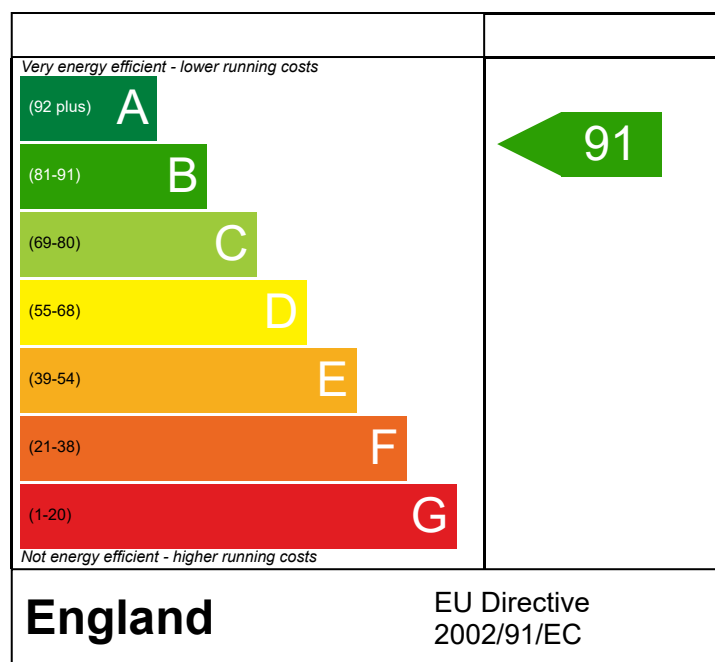
Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

House, Detached
01/04/2025
Paul Allen
253.44 m²

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

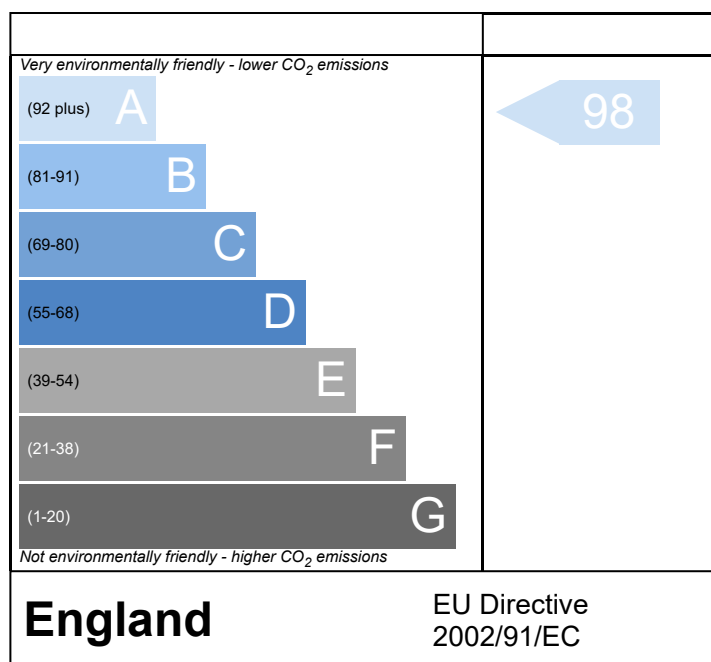
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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



Job no:	25.127
Date:	24/03/2025
Assessor name:	Paul Allen
Registration no:	APCOE-12
Development name:	Land between: Shangri-La & Todds Corner, Todds Green, Stevenage
Issue Date:	01/04/2025

Rainwater

Greywater

Results

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS

(for use with the Code for Sustainable Homes issues Wat 1 for the May 2009 and subsequent versions)

Dwelling Description	ALL PLOTS
-----------------------------	-----------

1st step - Select from options below:

Is a Rain and/or Greywater system specified?	No
Is a shower AND bath present?	Yes
Has a washing machine been specified?	Yes
Has a dishwasher been specified?	Yes

2nd step - Build spreadsheet (click button below)

BUILD SPREADSHEET

As soon as this button is pressed the spreadsheet will change according to the options selected previously in the 1st step. Scroll down to see the changes.

3rd step - Enter consumption details for the specified fittings

TAPS (excluding kitchen taps)		Fitting type	Flow rate (litres/min)	Number of fittings
	1	TARGET FLOW RATE	5.00	5
	2			
	3			
	4			
	Proportionate flow rate (litres/min)			3.50
	Consumption / person / day (Litres)			9.48

BATHS		Fitting type	Capacity to overflow (litres)	Number of fittings
	1	TARGET CAPACITY	170.00	1
	2			
	3			
	4			
		Proportionate capacity to overflow (litres)	119.00	
	Consumption / person / day (Litres)			18.70

SHOWERS		Fitting type	Flow rate (litres/min)	Number of fittings
	1	TARGET FLOW RATE	9.00	2
	2			
	3			
	4			
		Proportionate flow rate (litres/min)	6.30	
	Consumption / person / day (Litres)			39.33

DISHWASHER		Fitting Type	Litres per place setting	Number of fittings
	1	TARGET CONSUMPTION	0.75	1
	2			
	3			
	4			
		Proportionate litres per place setting	0.53	
	Consumption / person / day (Litres)			2.70

WASHING MACHINES		Fitting Type	Litres per kilogram of dry load	Number of fittings
	1	TARGET CONSUMPTION	5.00	1
	2			
	3			

4				
Where no washing machines have been specified but plumbing for future supply of grey/rainwater was installed, please enter details:				
		Proportionate of litres/kg of dry load	3.50	
		Consumption / person / day (Litres)	10.50	
WC's				
	Fitting Type	Flush Type	Volume**	Number of fittings
1	TARGET FLUSH	Full Flush	6.00	5
		Part Flush	3.00	
2		Full Flush		
		Part Flush		
3		Full Flush		
		Part Flush		
4		Full Flush		
		Part Flush		
		Average effective flushing volume (litres)	3.99	
		Consumption / person / day (Litres)	17.64	
KITCHEN SINK TAPS		Fitting Type	Flow rate (litres/minute)	Number of fittings
	1	TARGET FLOW RATE	10.00	2
	2			
	3			
	4			
		Proportionate flow rate (litres/min)	7.00	
		Consumption / person / day (Litres)	14.76	
WASTE DISPOSAL UNIT				
Is a waste disposal unit specified for the dwelling?		No		
		Consumption / person / day (Litres)	0.00	
WATER SOFTENER				
Water Softener in use?		No		
Total capacity used per regeneration (%)				

Water consumed per regeneration (litres)	
Average number of regeneration cycles per day (No.)	
Number of occupants served by the system (No.)	
Water consumed beyond 4% person / day (Litres)	0.00

4th step - Analyse Results[Go to Start](#)**INTERNAL WATER CONSUMPTION**

NET INTERNAL WATER CONSUMPTION	(litres/person/day)	113.11
RAINWATER ONLY COLLECTION SAVING	(litres/person/day)	0.00
GREYWATER ONLY RECYCLING SAVING	(litres/person/day)	0.00
RAIN/GREYWATER COLLECTION SAVING (combined system)	(litres/person/day)	0.00
NORMALISATION FACTOR	(litres/person/day)	0.91
TOTAL WATER CONSUMPTION	(litres/person/day)	102.9
CSH CREDITS ACHIEVED		3
CSH MANDATORY LEVEL:		Level 3/4

17. K COMPLIANCE

EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	107.9
17. K COMPLIANCE?		Yes

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