

Energy Statement

Erection of a building for use as an air B&B property
(use class C3- Commercial short let lettings)

at

Rear of 2 Gloucester Road,

READING, RG30 2TH

PL/25/1183

CLIENTS: Sykes Capital

PLANNING CONSULTANTS:
The Keen Partnership

October 2025

Prepared by:



accredited SAP assessors

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BRIEF

Monitor Energy Consultancy has been instructed to undertake an Energy Statement, to demonstrate how the proposed development for a new air B&B property will comply with the requirement of Reading Borough Council's Local Plan 2019 Policy 3.3: Carbon Reduction, which sets out that all new build residential properties must achieve a percentage reduction in carbon emissions in excess of 19% compared with Building Regulations Part L 2013 or the equivalent 9% reduction compared with the current Building Regulations Part L 2021.

ESTABLISHING CO₂ EMISSIONS

This energy statement seeks to identify the carbon footprint for this development and to demonstrate that the requirements of Policy 3.3 have been met.

The Standard Case TER and Actual DER Carbon Emissions have been calculated by SAP 10 in accordance with Building Regulations Part L 2021 with the results detailed below.

Table 1 illustrates the CO₂ emissions for the regulated loads (for heating, hot water, pumps, fans and lighting) associated with the dwelling if built to comply with Building Regulations Part L 2021. The SAP calculations confirming the TER can be found in the Appendix .

Total Area GIA	Standard Case TER (CO ₂ kg/m ² /yr)	Total CO ₂ (kg/yr)
18.14	28.83	522.97

Table 1: Standard (Notional) Case SAP 10 results for proposed new dwelling.

The total CO₂ emissions for the Building Regulations 2021 Compliant case has been calculated at 522.97 kg CO₂/yr. The calculated minimum 9% reduction in CO₂ required $522.97 \times 0.09 = 47.07$ kg CO₂/yr. The overall maximum CO₂ emissions to be achieved for the development is $522.97 - 47.07 = 475.90$ kg CO₂/yr. The figures calculated are tabulated in the summary below.

	Kg CO ₂ /yr
Building Regulations Compliant case (TER)	522.97
Minimum 9% target reduction of Standard case Emissions	47.07
Maximum CO ₂ emissions to be achieved	475.90

Table 2 - CO₂ emissions for Building Regulations Standard Case used to derive the 9% reduction required and to set the standard for achieving the planning requirement.

ENERGY EFFICIENCY MEASURES

In order to achieve the required target CO₂ emissions, a fabric first approach has been adopted, using enhanced standards of insulation for floor, walls and roof together with a low carbon heating system:

- U-Value for ground floors of 0.11 W/m²K using 175mm Celotex or similar PIR insulation compared to Building Regulations standard of 0.18 W/m²K,
- U-Value for cavity walls of 0.17 W/m²K using Aircrete blocks and 150mm Dritherm 32 insulation, compared to Building Regulations standard of 0.18 W/m²K,
- U-value for the sloping roof areas of 0.15 W/m²K using 80mm Celotex or similar PIR insulation between rafters plus 70mm below,
- High performing double-glazed doors windows and rooflights with low e glass and 16mm minimum gap, argon filled to achieve a maximum U-Value of 1.4 W/m²K compared to Building Regulations standard of 1.6 W/m²K,
- BRE approved thermal details eg Knauf, to be used for all junctions where applicable, to limit cold bridging at linear junctions with a calculated user defined psi values to achieve an average thermal bridging y value of 0.037 compared to standard default y value of 0.2,
- High levels of air tightness with a design air permeability rate of 5m³/hr/m³ at 50 Pa pressure compared to Building Regulations standard of 8m³/hr/m³
- Electric panel heaters together with electric instantaneous point of use water heating have been chosen for the most cost effective low carbon option for the heating system with individual time and temperature zone controls, to allow heating individual heaters to be controlled separately, in order to reduce unnecessary energy use,
- Water efficient sanitaryware, in particular flow restricton to the shower will be installed to reduce the demand for hot water, with calculations required to demonstrate a maximum of 110l of water use per day,
- 100% Low energy lights with a minimum efficiency of 100 lumens per watt,

The resulting CO₂ emissions have been calculated for the dwelling incorporating the above and the results shown in Table 3 below.

Total Area GIA	Interim Case DER (CO ₂ kg/m ² /yr)	Total CO ₂ (kg/yr)
18.14	19.4	347.2

Table 3: Actual Case SAP 10 results for the proposed new dwelling without renewable technology.

The results of this approach would satisfy the Planning requirement to reduce carbon emissions below 19% of 2013 Building Regulations, however in addition it is proposed to also install a minimum array of 1.5kWp of photovoltaic panels on the rear west facing roof which will be connected to the dwelling to offset the use of electric heating. The CO₂ emissions have been calculated for the dwelling as proposed, incorporating the PV and the results are shown in Table 4 below.

Total Area GIA	Interim Case DER (CO ₂ kg/m ² /yr)	Total CO ₂ (kg/yr)
18.14	11.82	214.41

Table 4: Actual Case SAP 10 results for the proposed new dwelling including renewable technology.

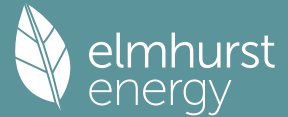
CONCLUSION

The total carbon emissions for the development as proposed are **214.41 kgCO₂/yr** compared with a maximum of **475.90 kg CO₂/yr.** required, a reduction of **59%** compared with 2021 Building Regulations. The proposals therefore satisfy Reading Borough Council's Planning requirement. The SAP calculations are appended with the TER calculation indicating the Building Regulation compliant case and the DER calculation indicating the dwelling as actually proposed.

APPENDIX A

TER AND DER CALCULATIONS

Full SAP Calculation Printout



Property Reference	01			Issued on Date	03/10/2025
Assessment Reference	Proposed	Prop Type Ref			
Property	Rear of, 2 Gloucester Road, Reading, RG30 2TH				
SAP Rating	76 C	DER	11.82	TER	28.83
Environmental	96 A	% DER < TER			59.00
CO ₂ Emissions (t/year)	0.16	DFEE	66.82	TFEE	71.68
Compliance Check	See BREL	% DFEE < TFEE			6.79
% DPER < TPER	4.76	DPER	146.75	TPER	154.08
Assessor Details	Mrs. Nicola Battista			Assessor ID	L706-0001
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	18.1400	3.0300	54.9642
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		
Dwelling volume			54.9642

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6139 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4758 (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	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590 (22b)
Effective ac	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Opening Type 1			2.2100	1.4000	3.0940		(26a)
Opening Type 2			1.5000	1.3258	1.9886		(27)
Opening Type 3			0.6800	1.3258	0.9015		(27a)
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000 (28a)
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000 (29a)
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400 (30)
Total net area of external elements Aum(A, m ²)			87.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 18.6540		(33)
Main dwelling							
Internal Wall 1			16.1500			9.0000	145.3500 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4978.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							274.4427 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				2.3000	0.0500	0.1150	
E3 Sill				1.2500	0.0240	0.0300	
E4 Jamb				6.6000	0.0190	0.1254	
E5 Ground floor (normal)				17.7300	0.0410	0.7269	
E16 Corner (normal)				12.1200	0.0400	0.4848	

Full SAP Calculation Printout



R1 Head of roof window	0.9000	0.2400	0.2160
R2 Sill of roof window	0.9000	0.2400	0.2160
R3 Jamb of roof window	3.0000	0.2400	0.7200
E11 Eaves (insulation at rafter level)	11.2000	0.0200	0.2240
E13 Gable (insulation at rafter level)	7.8000	0.0550	0.4290
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.2871 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	21.9411 (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	12.4060	12.2764	12.1494	11.5529	11.4412	10.9217	10.9217	10.8254	11.1218	11.4412	11.6670	11.9031 (38)
Average = Sum(39)m / 12 =	34.3471	34.2175	34.0905	33.4939	33.3823	32.8627	32.8627	32.7665	33.0629	33.3823	33.6081	33.8442 (39)
												33.4934
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8934	1.8863	1.8793	1.8464	1.8403	1.8116	1.8116	1.8063	1.8226	1.8403	1.8527	1.8657 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
												1.8464

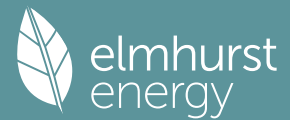
4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.0165 (42)
Hot water usage for mixer showers												65.8637 (42a)
Hot water usage for baths												0.0000 (42b)
Hot water usage for other uses												25.0402 (42c)
Average daily hot water use (litres/day)												83.7215 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	91.1572	89.2530	86.8946	83.2138	80.2588	77.0684	75.7725	78.1200	80.6057	83.9641	87.7045	90.9039 (44)
Energy content (annual)	144.3707	127.0951	133.5538	113.9155	108.0438	94.7646	91.6403	96.7289	99.3949	113.9385	124.9511	142.3335 (45)
Distribution loss (46)m = 0.15 x (45)m												1390.7307
Water storage loss:												
Total storage loss												0.0000 (46)
If cylinder contains dedicated solar storage												0.0000 (56)
Primary loss												0.0000 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month												0.0000 (61)
WWHRS	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (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	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (64)
12Total per year (kWh/year)												1182.1211 (64)
Electric shower(s)												1182 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												0.0000 (64a)
	30.6788	27.0077	28.3802	24.2070	22.9593	20.1375	19.4736	20.5549	21.1214	24.2119	26.5521	30.2459 (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	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.6567	43.9057	39.6567	40.9786	39.6567	40.9786	39.6567	39.6567	40.9786	39.6567	40.9786	39.6567 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	71.8376	72.5830	70.7045	66.7054	61.6572	56.9126	53.7430	52.9975	54.8760	58.8752	63.9233	68.6679 (68)
Pumps, fans	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826 (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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608 (71)
Total internal gains	41.2349	40.1901	38.1454	33.6209	30.8593	27.9687	26.1741	27.6275	29.3353	32.5429	36.8779	40.6530 (72)
	190.9770	194.9265	186.7544	179.5527	170.4210	164.1078	157.8216	158.5296	163.4377	169.3226	180.0277	187.2255 (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							
South	1.5000	46.7521	0.6300	0.7000	0.7700	21.4321 (78)						
East	0.3400	26.0000	0.6300	0.7000	1.0000	3.5086 (82)						
West	0.3400	26.0000	0.6300	0.7000	1.0000	3.5086 (82)						
Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107	24.1870 (83)
Total gains	219.4262	244.6009	257.3755	270.5701	274.8994	268.7634	258.3460	248.9883	241.1817	224.9943	214.3384	211.4125 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.2621	40.4146	40.5651	41.2877	41.4257	42.0807	42.0807	42.2043	41.8260	41.4257	41.1474	40.8604	
alpha	3.6841	3.6943	3.7043	3.7525	3.7617	3.8054	3.8054	3.8136	3.7884	3.7617	3.7432	3.7240	
util living area	0.9819	0.9717	0.9552	0.9145	0.8351	0.6859	0.5308	0.5667	0.7686	0.9212	0.9700	0.9841	(86)
MIT	19.2548	19.4720	19.7866	20.2254	20.6027	20.8718	20.9632	20.9524	20.7894	20.3127	19.7289	19.2358	(87)
Th 2	19.4053	19.4102	19.4150	19.4377	19.4420	19.4619	19.4619	19.4656	19.4542	19.4420	19.4333	19.4244	(88)
util rest of house	0.9753	0.9615	0.9382	0.8800	0.7649	0.5582	0.3591	0.3958	0.6557	0.8820	0.9572	0.9783	(89)
MIT 2	17.4994	17.7745	18.1692	18.7144	19.1384	19.4001	19.4537	19.4535	19.3348	18.8323	18.1164	17.4877	(90)
Living area fraction									FLA = Living area /	(4) =		0.8456	(91)
MIT	18.9838	19.2100	19.5370	19.9921	20.3767	20.6446	20.7302	20.7211	20.5649	20.0842	19.4800	18.9660	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9838	19.2100	19.5370	19.9921	20.3767	20.6446	20.7302	20.7211	20.5649	20.0842	19.4800	18.9660	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9731	0.9599	0.9398	0.8938	0.8101	0.6594	0.5028	0.5381	0.7410	0.9004	0.9577	0.9762	(94)
Useful gains	213.5299	234.7995	241.8696	241.8311	222.7020	177.2317	129.9030	133.9904	178.7043	202.5739	205.2700	206.3723	(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	504.3466	489.6523	444.4376	371.5196	289.6485	198.6428	135.7306	141.5867	213.7475	316.6040	416.0682	499.7417	(97)
Space heating kWh	216.3676	171.2610	150.7106	93.3757	49.8082	0.0000	0.0000	0.0000	0.0000	84.8384	151.7747	218.2669	(98a)
Space heating requirement - total per year (kWh/year)												1136.4032	
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	216.3676	171.2610	150.7106	93.3757	49.8082	0.0000	0.0000	0.0000	0.0000	84.8384	151.7747	218.2669	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1136.4032	
Space heating per m2										(98c) / (4) =		62.6463	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													100.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	216.3676	171.2610	150.7106	93.3757	49.8082	0.0000	0.0000	0.0000	0.0000	84.8384	151.7747	218.2669	(98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)	
Space heating fuel (main heating system)	216.3676	171.2610	150.7106	93.3757	49.8082	0.0000	0.0000	0.0000	0.0000	84.8384	151.7747	218.2669	(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	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835	(64)	
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)	
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)	
Fuel for water heating, kWh/month	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835	(219)	
Space cooling fuel requirement														
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)	
Lighting	7.6673	6.1510	5.5383	4.0576	3.1342	2.5607	2.8591	3.7164	4.8272	6.3335	7.1537	7.8804	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-18.8561	-30.7816	-51.1633	-62.6409	-68.1379	-57.2599	-56.0073	-51.9678	-43.5488	-36.2430	-21.6849	-15.7098	(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	-4.8988	-12.5963	-31.8191	-60.4278	-93.2034	-104.9327	-102.5519	-80.5516	-51.7816	-21.7643	-7.2490	-3.6473	(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													1136.4032	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													100.0000	
Water heating fuel used													1182.1211	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													61.8792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1089.4251	(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)

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Total delivered energy for all uses

1290.9784 (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	1136.4032	0.1546	175.6893 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1182.1211	0.1416	167.3823 (264)
Space and water heating			343.0716 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	61.8792	0.1443	8.9311 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-514.0013	0.1338	-68.7640
PV Unit electricity exported	-575.4238	0.1197	-68.8825
Total			-137.6464 (269)
Total CO2, kg/year			214.3562 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.8200 (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	1136.4032	1.5724	1786.8457 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1182.1211	1.5236	1801.0808 (278)
Space and water heating			3587.9265 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	61.8792	1.5338	94.9123 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-514.0013	1.4944	-768.1359
PV Unit electricity exported	-575.4238	0.4390	-252.6172
Total			-1020.7531 (283)
Total Primary energy kWh/year			2662.0858 (286)
Dwelling Primary energy Rate (DPER)			146.7500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	18.1400	3.0300	54.9642
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		
Dwelling volume			

2. Ventilation rate

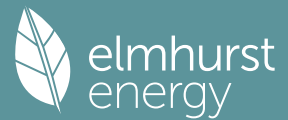
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6139 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4758 (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	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590 (22b)
Effective ac	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562 (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							

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TER Semi-glazed door		2.2100	1.0000	2.2100	(26a)
TER Opening Type		1.5000	1.1450	1.7176	(27)
TER Roof Window		0.6800	1.1450	1.0824	(27a)
Heatloss Floor 1		18.1400	0.1300	2.3582	(28a)
External Wall 1	47.8300	3.7100	0.1800	7.9416	(29a)
External Roof 1	21.8400	0.6800	0.1100	2.3276	(30)
Total net area of external elements Aum(A, m2)		87.8100			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	17.6374		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 274.4427 (35)

List of Thermal Bridges					
K1 Element		Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)		2.3000	0.0500	0.1150	
E3 Sill		1.2500	0.0500	0.0625	
E4 Jamb		6.6000	0.0500	0.3300	
E5 Ground floor (normal)		17.7300	0.1600	2.8368	
E16 Corner (normal)		12.1200	0.0900	1.0908	
R1 Head of roof window		0.9000	0.0800	0.0720	
R2 Sill of roof window		0.9000	0.0600	0.0540	
R3 Jamb of roof window		3.0000	0.0800	0.2400	
E11 Eaves (insulation at rafter level)		11.2000	0.0400	0.4480	
E13 Gable (insulation at rafter level)		7.8000	0.0800	0.6240	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8731 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 23.5105 (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	12.4060	12.2764	12.1494	11.5529	11.4412	10.9217	10.9217	10.8254	11.1218	11.4412	11.6670	11.9031	(38)
Average = Sum(39)m / 12 =	35.9165	35.7869	35.6599	35.0633	34.9517	34.4321	34.4321	34.3359	34.6322	34.9517	35.1775	35.4136	(39)
												35.0628	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.9800	1.9728	1.9658	1.9329	1.9268	1.8981	1.8981	1.8928	1.9092	1.9268	1.9392	1.9522	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

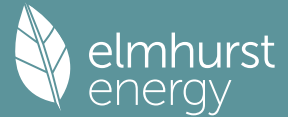
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0165 (42)
Hot water usage for mixer showers													
Hot water usage for baths	52.8936	52.0987	50.9404	48.7242	47.0887	45.2648	44.2281	45.3776	46.6377	48.5961	50.8599	52.6910	(42a)
Hot water usage for other uses	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)
Average daily hot water use (litres/day)	25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402	(42c)
												71.5299	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	77.9338	76.2284	74.1595	71.0327	68.4867	65.7522	64.7155	66.7756	68.9463	71.8151	74.9895	77.7311	(44)
Energy content (annual)	123.4281	108.5482	113.9804	97.2403	92.1962	80.8500	78.2678	82.6821	85.0176	97.4525	106.8363	121.7082	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	18.5142	16.2822	17.0971	14.5860	13.8294	12.1275	11.7402	12.4023	12.7526	14.6179	16.0254	18.2562	(46)
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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	170.0230	150.6339	160.5753	142.3321	138.7911	125.9419	124.8627	129.2770	130.1095	144.0474	151.9281	168.3031	(62)
WWHRS	-24.1807	-21.3857	-22.3938	-18.5430	-17.2814	-14.7878	-13.8612	-14.7400	-15.3000	-18.0370	-20.4338	-23.7330	(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	145.8422	129.2482	138.1815	123.7891	121.5097	111.1541	111.0015	114.5370	114.8094	126.0103	131.4943	144.5701	(64)
12Total per year (kWh/year)													1512.1475 (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	78.3158	69.7608	75.1744	68.4059	67.9312	62.9561	63.3000	64.7677	64.3418	69.6789	71.5965	77.7439	(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	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.6567	43.9057	39.6567	40.9786	39.6567	40.9786	39.6567	39.6567	40.9786	39.6567	40.9786	39.6567	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	71.8376	72.5830	70.7045	66.7054	61.6572	56.9126	53.7430	52.9975	54.8760	58.8752	63.9233	68.6679	(68)
Pumps, fans	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	(71)
Total internal gains	105.2631	103.8108	101.0409	95.0081	91.3053	87.4390	85.0806	87.0534	89.3637	93.6544	99.4396	104.4945	(72)
	258.0052	261.5472	252.6499	243.9399	233.8671	223.5781	216.7281	217.9554	223.4661	233.4341	245.5894	254.0669	(73)

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6. Solar gains

[Jan]	Area				Solar flux	g	Specific data	FF	Access	Gains		
	m2				Table 6a	or Table 6b	Specific data	or Table 6c	factor	W		
					W/m2				Table 6d			
South	1.5000				46.7521	0.6300		0.7000	0.7700	21.4321	(78)	
East	0.3400				26.0000	0.6300		0.7000	1.0000	3.5086	(82)	
West	0.3400				26.0000	0.6300		0.7000	1.0000	3.5086	(82)	
Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107	24.1870 (83)
Total gains	286.4544	311.2216	323.2709	334.9573	338.3455	328.2337	317.2524	308.4142	301.2100	289.1058	279.9001	278.2539 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.5028	38.6423	38.7799	39.4397	39.5656	40.1627	40.1627	40.2752	39.9306	39.5656	39.3117	39.0496
alpha	3.5669	3.5762	3.5853	3.6293	3.6377	3.6775	3.6775	3.6850	3.6620	3.6377	3.6208	3.6033
util living area	0.9612	0.9460	0.9213	0.8658	0.7684	0.6110	0.4605	0.4899	0.6870	0.8640	0.9386	0.9645 (86)
MIT	19.4392	19.6431	19.9431	20.3496	20.6845	20.9036	20.9737	20.9667	20.8442	20.4487	19.9050	19.4226 (87)
Th 2	20.0100	20.0136	20.0171	20.0335	20.0366	20.0509	20.0509	20.0536	20.0454	20.0366	20.0304	20.0239 (88)
util rest of house	0.9541	0.9361	0.9064	0.8396	0.7224	0.5380	0.3681	0.3979	0.6189	0.8328	0.9258	0.9579 (89)
MIT 2	18.6104	18.8119	19.1059	19.5048	19.8089	19.9969	20.0411	20.0402	19.9507	19.6048	19.0832	18.6046 (90)
Living area fraction									fLA = Living area / (4) =			0.8456 (91)
MIT	19.3113	19.5148	19.8139	20.2192	20.5493	20.7636	20.8298	20.8237	20.7063	20.3184	19.7782	19.2963 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3113	19.5148	19.8139	20.2192	20.5493	20.7636	20.8298	20.8237	20.7063	20.3184	19.7782	19.2963 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9480	0.9303	0.9029	0.8450	0.7479	0.5937	0.4445	0.4734	0.6672	0.8427	0.9220	0.9520 (94)
Useful gains	271.5551	289.5139	291.8787	283.0551	253.0407	194.8824	141.0214	146.0089	200.9807	243.6252	258.0677	264.9064 (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	539.1530	523.0192	474.7723	396.8889	309.2992	212.2265	145.6399	151.8901	228.7908	339.6746	445.9863	534.6135 (97)
Space heating kWh	199.0928	156.9155	136.0728	81.9603	41.8563	0.0000	0.0000	0.0000	0.0000	71.4607	135.3013	200.6621 (98a)
Space heating requirement - total per year (kWh/year)												1023.3220
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	199.0928	156.9155	136.0728	81.9603	41.8563	0.0000	0.0000	0.0000	0.0000	71.4607	135.3013	200.6621 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1023.3220
Space heating per m2										(98c) / (4) =		56.4125 (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	199.0928	156.9155	136.0728	81.9603	41.8563	0.0000	0.0000	0.0000	0.0000	71.4607	135.3013	200.6621 (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)	215.7019	170.0060	147.4245	88.7978	45.3481	0.0000	0.0000	0.0000	0.0000	77.4223	146.5887	217.4021 (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	145.8422	129.2482	138.1815	123.7891	121.5097	111.1541	111.0015	114.5370	114.8094	126.0103	131.4943	144.5701 (64)
Efficiency of water heater (217)m	84.7583	84.4959	84.0253	83.1573	81.9274	79.8000	79.8000	79.8000	79.8000	82.8383	84.1239	79.8000 (216)
Fuel for water heating, kWh/month	172.0684	152.9639	164.4522	148.8613	148.3138	139.2908	139.0996	143.5301	143.8715	152.1161	156.3104	170.4932 (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	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	8.2399	6.6103	5.9519	4.3606	3.3683	2.7519	3.0726	3.9939	5.1877	6.8066	7.6880	8.4689 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-16.1391	-22.3353	-31.5803	-35.0076	-37.4746	-35.0436	-34.7646	-33.0404	-29.8180	-25.4739	-17.6611	-14.0174 (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	-10.4214	-21.7639	-42.9096	-63.8922	-83.8701	-83.9064	-82.7624	-70.2085	-51.7501	-30.7361	-13.8001	-8.2382 (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)												

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(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												1108.6913	(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												1831.3714	(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)												66.5006	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-896.6149	(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												2195.9483	(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	1108.6913	0.2100	232.8252	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1831.3714	0.2100	384.5880	(264)
Space and water heating			617.4132	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	66.5006	0.1443	9.5981	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-332.3559	0.1348	-44.8074	
PV Unit electricity exported	-564.2590	0.1262	-71.2085	
Total			-116.0159	(269)
Total CO2, kg/year			522.9246	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			28.8300	(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	1108.6913	1.1300	1252.8211	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1831.3714	1.1300	2069.4497	(278)
Space and water heating			3322.2708	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	66.5006	1.5338	102.0008	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-332.3559	1.4983	-497.9602	
PV Unit electricity exported	-564.2590	0.4633	-261.3944	
Total			-759.3546	(283)
Total Primary energy kWh/year			2795.0179	(286)
Target Primary Energy Rate (TPER)			154.0800	(287)

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

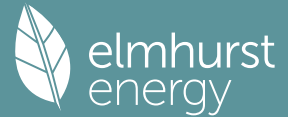
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	18.1400	3.0300	54.9642	(1b) - (3b)
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400			(5)
Dwelling volume				

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3639 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.6139 (18)

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Number of sides sheltered

3 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.7750 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.4758 \quad (21)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590	(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	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			2.2100	1.4000	3.0940			(26a)
Opening Type 2			1.5000	1.3258	1.9886			(27)
Opening Type 3			0.6800	1.3258	0.9015			(27a)
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000	(28a)
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000	(29a)
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400	(30)
Total net area of external elements Aum(A, m2)			87.8100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 18.6540			(33)
Main dwelling								
Internal Wall 1			16.1500			9.0000	145.3500	(32c)

Heat capacity Cm = Sum(A x k)

$$(28)...(30) + (32) + (32a)...(32e) = 4978.3900 \quad (34)$$

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

$$274.4427 \quad (35)$$

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	2.3000	0.0500	0.1150	
E2 Other lintels (including other steel lintels)	1.2500	0.0240	0.0300	
E3 Sill	6.6000	0.0190	0.1254	
E4 Jamb	17.7300	0.0410	0.7269	
E5 Ground floor (normal)	12.1200	0.0400	0.4848	
E6 Corner (normal)	0.9000	0.2400	0.2160	
R1 Head of roof window	0.9000	0.2400	0.2160	
R2 Sill of roof window	3.0000	0.2400	0.7200	
R3 Jamb of roof window	11.2000	0.0200	0.2240	
E11 Eaves (insulation at rafter level)	7.8000	0.0550	0.4290	
E13 Gable (insulation at rafter level)				

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

$$3.2871 \quad (36)$$

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 21.9411 \quad (37)$$

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

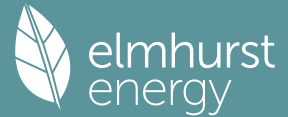
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.4060	12.2764	12.1494	11.5529	11.4412	10.9217	10.9217	10.8254	11.1218	11.4412	11.6670	11.9031	(38)
Heat transfer coeff	34.3471	34.2175	34.0905	33.4939	33.3823	32.8627	32.8627	32.7665	33.0629	33.3823	33.6081	33.8442	(39)
Average = Sum(39)m / 12 =													33.4934

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8934	1.8863	1.8793	1.8464	1.8403	1.8116	1.8116	1.8063	1.8226	1.8403	1.8527	1.8657	(40)
HLP (average)													1.8464
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0165 (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													
17.8677	17.6023	17.2286	16.5396	16.0237	15.4516	15.1426	15.5137	15.9177	16.5299	17.2331	17.8073	17.8073	(42b)
Hot water usage for other uses													
25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402	25.0402	(42c)
Average daily hot water use (litres/day)													39.3299 (43)
Daily hot water use													
42.9079	41.7319	40.4477	38.8482	37.4217	35.9391	35.6301	36.9117	38.2263	39.7489	41.3627	42.8474	42.8474	(44)
Energy conte	67.9555	59.4257	62.1666	53.1812	50.3768	44.1913	43.0915	45.7044	47.1368	53.9389	58.9287	67.0887	(45)
Energy content (annual)										Total = Sum(45)m =			653.1861
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	(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													
57.7622	50.5119	52.8416	45.2040	42.8203	37.5626	36.6277	38.8487	40.0663	45.8481	50.0894	57.0254	57.0254	(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	57.7622	50.5119	52.8416	45.2040	42.8203	37.5626	36.6277	38.8487	40.0663	45.8481	50.0894	57.0254	(64)
Total per year (kWh/year) = Sum(64)m =													555.2082 (64)
Electric shower(s)	33.0448	29.4432	32.1508	30.6811	31.2568	29.8160	30.8099	31.2568	30.6811	32.1508	31.5463	33.0448	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													375.8824 (64a)
Heat gains from water heating, kWh/month													
22.7017	19.9888	21.2481	18.9713	18.5193	16.8446	16.8594	17.5264	17.6868	19.4997	20.4089	22.5176	22.5176	(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	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.6567	43.9057	39.6567	40.9786	39.6567	40.9786	39.6567	39.6567	40.9786	39.6567	40.9786	39.6567	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	71.8376	72.5830	70.7045	66.7054	61.6572	56.9126	53.7430	52.9975	54.8760	58.8752	63.9233	68.6679	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	(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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	(71)
Water heating gains (Table 5)	30.5131	29.7452	28.5593	26.3490	24.8915	23.3953	22.6605	23.5570	24.5651	26.2093	28.3457	30.2655	(72)
Total internal gains	180.2552	184.4816	177.1683	172.2808	164.4532	159.5344	154.3080	154.4590	158.6675	162.9890	171.4955	176.8379	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
South				1.5000	46.7521	0.6300		0.7000			0.7700			21.4321 (78)
East				0.3400	26.0000	0.6300		0.7000			1.0000			3.5086 (82)
West				0.3400	26.0000	0.6300		0.7000			1.0000			3.5086 (82)
Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107			24.1870 (83)
Total gains	208.7044	234.1560	247.7894	263.2982	268.9316	264.1900	254.8323	244.9178	236.4114	218.6607	205.8062			201.0249 (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	40.2621	40.4146	40.5651	41.2877	41.4257	42.0807	42.0807	42.2043	41.8260	41.4257	41.1474	40.8604	
alpha	3.6841	3.6943	3.7043	3.7525	3.7617	3.8054	3.8054	3.8136	3.7884	3.7617	3.7432	3.7240	
util living area	0.9845	0.9752	0.9598	0.9203	0.8426	0.6937	0.5370	0.5743	0.7768	0.9269	0.9734	0.9864	(86)
MIT	19.2062	19.4265	19.7475	20.2002	20.5881	20.8666	20.9618	20.9502	20.7809	20.2902	19.6918	19.1881	(87)
Th 2	19.4053	19.4102	19.4150	19.4377	19.4420	19.4619	19.4619	19.4656	19.4542	19.4420	19.4333	19.4244	(88)
util rest of house	0.9788	0.9661	0.9443	0.8875	0.7740	0.5661	0.3638	0.4019	0.6649	0.8897	0.9620	0.9815	(89)
MIT 2	17.8726	18.0917	18.4076	18.8523	19.1949	19.4114	19.4552	19.4557	19.3565	18.9477	18.3718	17.8685	(90)
Living area fraction													(91)
MIT	19.0003	19.2205	19.5407	19.9922	20.3731	20.6419	20.7292	20.7196	20.5611	20.0830	19.4881	18.9844	(92)
Temperature adjustment													(93)
adjusted MIT	19.0003	19.2205	19.5407	19.9922	20.3731	20.6419	20.7292	20.7196	20.5611	20.0830	19.4881	18.9844	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9770	0.9648	0.9458	0.9006	0.8181	0.6672	0.5087	0.5454	0.7493	0.9072	0.9625	0.9797	(94)
Useful gains	203.9033	225.9088	234.3474	237.1354	220.0139	176.2673	129.6382	133.5891	177.1462	198.3622	198.0864	196.9402	(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	504.9131	490.0110	444.5641	371.5206	289.5280	198.5548	135.6977	141.5367	213.6211	316.5629	416.3400	500.3659	(97)
Space heating kWh	223.9513	177.4767	156.4012	96.7574	51.7185	0.0000	0.0000	0.0000	0.0000	87.9413	157.1425	225.7487	(98a)
Space heating requirement - total per year (kWh/year)												1177.1376	
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	223.9513	177.4767	156.4012	96.7574	51.7185	0.0000	0.0000	0.0000	0.0000	87.9413	157.1425	225.7487	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1177.1376	
Space heating per m ²										(98c) / (4) =		64.8918	(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	308.9097	243.1842	249.0255	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7625	0.8412	0.8211	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	235.5455	204.5769	204.4632	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	287.4670	277.9532	268.5543	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.3834	54.5919	47.6838	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction													(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	9.3459	13.6480	11.9209	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													(108)
Energy for space heating													(109)
Energy for space cooling													(110)
Total													(111)
Fabric Energy Efficiency (DFEE)													(112)

Full SAP Calculation Printout



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	18.1400 (1b)	x 3.0300 (2b)	= 54.9642 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 54.9642 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6139 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4758 (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	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590 (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	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562 (25)

3. Heat losses and heat loss parameter

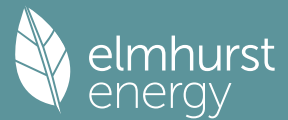
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.2100	1.0000	2.2100		(26a)
TER Opening Type			1.5000	1.1450	1.7176		(27)
TER Roof Window			0.6800	1.1450	1.0824		(27a)
Heatloss Floor 1			18.1400	0.1300	2.3582		(28a)
External Wall 1	47.8300	3.7100	44.1200	0.1800	7.9416		(29a)
External Roof 1	21.8400	0.6800	21.1600	0.1100	2.3276		(30)
Total net area of external elements Aum(A, m ²)			87.8100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 17.6374		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							274.4427 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				2.3000	0.0500	0.1150	
E3 Sill				1.2500	0.0500	0.0625	
E4 Jamb				6.6000	0.0500	0.3300	
E5 Ground floor (normal)				17.7300	0.1600	2.8368	
E16 Corner (normal)				12.1200	0.0900	1.0908	
R1 Head of roof window				0.9000	0.0800	0.0720	
R2 Sill of roof window				0.9000	0.0600	0.0540	
R3 Jamb of roof window				3.0000	0.0800	0.2400	
E11 Eaves (insulation at rafter level)				11.2000	0.0400	0.4480	
E13 Gable (insulation at rafter level)				7.8000	0.0800	0.6240	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8731 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	23.5105 (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	12.4060	12.2764	12.1494	11.5529	11.4412	10.9217	10.9217	10.8254	11.1218	11.4412	11.6670	11.9031 (38)
Average = Sum(39)m / 12 =	35.9165	35.7869	35.6599	35.0633	34.9517	34.4321	34.4321	34.3359	34.6322	34.9517	35.1775	35.4136 (39)
												35.0628
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.9800	1.9728	1.9658	1.9329	1.9268	1.8981	1.8981	1.8928	1.9092	1.9268	1.9392	1.9522 (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	1.0165 (42)
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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	17.8677	17.6023	17.2286	16.5396	16.0237	15.4516	15.1426	15.5137	15.9177	16.5299	17.2331	17.8073 (42b)
Hot water usage for other uses	25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402 (42c)
Average daily hot water use (litres/day)												39.3299 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	42.9079	41.7319	40.4477	38.8482	37.4217	35.9391	35.6301	36.9117	38.2263	39.7489	41.3627	42.8474 (44)
Distribution loss (46)m = 0.15 x (45)m	67.9555	59.4257	62.1666	53.1812	50.3768	44.1913	43.0915	45.7044	47.1368	53.9389	58.9287	67.0887 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	57.7622	50.5119	52.8416	45.2040	42.8203	37.5626	36.6277	38.8487	40.0663	45.8481	50.0894	57.0254 (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	57.7622	50.5119	52.8416	45.2040	42.8203	37.5626	36.6277	38.8487	40.0663	45.8481	50.0894	57.0254 (64)
12Total per year (kWh/year)												555.2082 (64a)
Electric shower(s)	33.0448	29.4432	32.1508	30.6811	31.2568	29.8160	30.8099	31.2568	30.6811	32.1508	31.5463	33.0448 (64a)
Heat gains from water heating, kWh/month	22.7017	19.9888	21.2481	18.9713	18.5193	16.8446	16.8594	17.5264	17.6868	19.4997	20.4089	22.5176 (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	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260	50.8260 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.6567	43.9057	39.6567	40.9786	39.6567	40.9786	39.6567	39.6567	40.9786	39.6567	40.9786	39.6567 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	71.8376	72.5830	70.7045	66.7054	61.6572	56.9126	53.7430	52.9975	54.8760	58.8752	63.9233	68.6679 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826	28.0826 (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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608 (71)
Water heating gains (Table 5)	30.5131	29.7452	28.5593	26.3490	24.8915	23.3953	22.6605	23.5570	24.5651	26.2093	28.3457	30.2655 (72)
Total internal gains	180.2552	184.4816	177.1683	172.2808	164.4532	159.5344	154.3080	154.4590	158.6675	162.9890	171.4955	176.8379 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
South					1.5000	46.7521		0.6300	0.7000	0.7700		21.4321 (78)
East					0.3400	26.0000		0.6300	0.7000	1.0000		3.5086 (82)
West					0.3400	26.0000		0.6300	0.7000	1.0000		3.5086 (82)
Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107	24.1870 (83)
Total gains	208.7044	234.1560	247.7894	263.2982	268.9316	264.1900	254.8323	244.9178	236.4114	218.6607	205.8062	201.0249 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.5028	38.6423	38.7799	39.4397	39.5656	40.1627	40.1627	40.2752	39.9306	39.5656	39.3117	39.0496
alpha	3.5669	3.5762	3.5853	3.6293	3.6377	3.6775	3.6775	3.6850	3.6620	3.6377	3.6208	3.6033
util living area	0.9848	0.9759	0.9614	0.9245	0.8518	0.7099	0.5555	0.5927	0.7897	0.9307	0.9743	0.9866 (86)
MIT	19.1034	19.3258	19.6558	20.1240	20.5347	20.8403	20.9516	20.9377	20.7459	20.2243	19.6040	19.0843 (87)
Th 2	19.3467	19.3515	19.3562	19.3784	19.3826	19.4021	19.4021	19.4057	19.3946	19.3826	19.3742	19.3654 (88)
util rest of house	0.9791	0.9669	0.9462	0.8924	0.7838	0.5788	0.3719	0.4111	0.6767	0.8943	0.9630	0.9817 (89)
MIT 2	17.7300	17.9514	18.2764	18.7369	19.1026	19.3416	19.3938	19.3935	19.2809	18.8424	18.2437	17.7244 (90)
Living area fraction	18.8914	19.1137	19.4429	19.9099	20.3137	20.6089	20.7111	20.6994	20.5198	20.0110	19.3940	18.8744 (92)
Temperature adjustment	18.8914	19.1137	19.4429	19.9099	20.3137	20.6089	20.7111	20.6994	20.5198	20.0110	19.3940	18.8744 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9771	0.9653	0.9472	0.9045	0.8263	0.6817	0.5251	0.5619	0.7608	0.9106	0.9632	0.9797 (94)
Ext temp.	203.9264	226.0391	234.6944	238.1427	222.2147	180.0943	133.8181	137.6103	179.8515	199.1226	198.2298	196.9506 (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)

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Space heating kWh	524.0706	508.6634	461.5430	386.0432	301.0617	206.9002	141.5541	147.6230	222.3311	328.9297	432.4730	519.6713 (97)
Space heating requirement - total per year (kWh/year)	238.1873	189.9235	168.7753	106.4884	58.6622	0.0000	0.0000	0.0000	0.0000	96.5765	168.6551	240.1042 (98a)
Solar heating kWh												1267.3725
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	238.1873	189.9235	168.7753	106.4884	58.6622	0.0000	0.0000	0.0000	0.0000	96.5765	168.6551	240.1042 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1267.3725
Space heating per m2										(98c) / (4) =		69.8662 (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	323.6618	254.7976	260.9527	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7373	0.8190	0.7977	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	238.6500	208.6802	208.1615	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	287.4670	277.9532	268.5543	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	35.1482	51.5391	44.9322	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	8.7871	12.8848	11.2331	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												32.9049 (107)
Energy for space heating												69.8662 (99)
Energy for space cooling												1.8139 (108)
Total												71.6801 (109)
Fabric Energy Efficiency (TFEE)												71.7 (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	18.1400	3.0300	54.9642
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		54.9642 (1b) - (3b)
Dwelling volume			54.9642 (4)
		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	54.9642 (5)

2. Ventilation rate

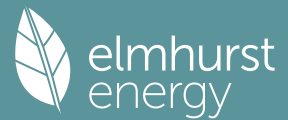
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.3639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6139 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4758 (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	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590 (22b)
Effective ac	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Opening Type 1			2.2100	1.4000	3.0940		(26a)
Opening Type 2			1.5000	1.3258	1.9886		(27)
Opening Type 3			0.6800	1.3258	0.9015		(27a)
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000 (28a)
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000 (29a)
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400 (30)

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Total net area of external elements Aum(A, m2)	87.8100	(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) = 18.6540	(33)
Main dwelling		
Internal Wall 1	16.1500	9.0000 145.3500 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 4978.3900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		274.4427 (35)
List of Thermal Bridges		
K1 Element	Length	Psi-value
E2 Other lintels (including other steel lintels)	2.3000	0.0500
E3 Sill	1.2500	0.0240
E4 Jamb	6.6000	0.0190
E5 Ground floor (normal)	17.7300	0.0410
E16 Corner (normal)	12.1200	0.0400
R1 Head of roof window	0.9000	0.2400
R2 Sill of roof window	0.9000	0.2400
R3 Jamb of roof window	3.0000	0.2400
E11 Eaves (insulation at rafter level)	11.2000	0.0200
E13 Gable (insulation at rafter level)	7.8000	0.0550
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.2871 (36)
Point Thermal bridges		(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =	21.9411 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)		
(38)m	Jan 12.4060 Feb 12.2764 Mar 12.1494 Apr 11.5529 May 11.4412 Jun 10.9217 Jul 10.9217 Aug 10.8254 Sep 11.1218 Oct 11.4412 Nov 11.6670 Dec 11.9031	(38)
Heat transfer coeff	34.3471 34.2175 34.0905 33.4939 33.3823 32.8627 32.8627 32.7665 33.0629 33.3823 33.6081 33.8442	(39)
Average = Sum(39)m / 12 =		33.4934
HLP	Jan 1.8934 Feb 1.8863 Mar 1.8793 Apr 1.8464 May 1.8403 Jun 1.8116 Jul 1.8116 Aug 1.8063 Sep 1.8226 Oct 1.8403 Nov 1.8527 Dec 1.8657	(40)
HLP (average)		1.8464
Days in mont	31 28 31 30 31 30 31 31 30 31 30 31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.0165 (42)
Hot water usage for mixer showers		
66.1170 65.1234 63.6755 60.9053 58.8609 56.5810 55.2851 56.7220 58.2972 60.7451 63.5748 65.8637		(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		(42b)
Hot water usage for other uses		
25.0402 24.1296 23.2191 22.3085 21.3980 20.4874 20.4874 21.3980 22.3085 23.2191 24.1296 25.0402		(42c)
Average daily hot water use (litres/day)		83.7215 (43)
Daily hot water use		
91.1572 89.2530 86.8946 83.2138 80.2588 77.0684 75.7725 78.1200 80.6057 83.9641 87.7045 90.9039		(44)
Energy conte 144.3707 127.0951 133.5538 113.9155 108.0438 94.7646 91.6403 96.7289 99.3949 113.9385 124.9511 142.3335		(45)
Energy content (annual)		Total = Sum(45)m = 1390.7307
Distribution loss (46)m = 0.15 x (45)m		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(46)
Water storage loss:		
Total storage loss		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(56)
If cylinder contains dedicated solar storage		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(57)
Primary loss		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(59)
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		
122.7151 108.0309 113.5207 96.8282 91.8372 80.5499 77.8943 82.2195 84.4856 96.8478 106.2084 120.9835		(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		
122.7151 108.0309 113.5207 96.8282 91.8372 80.5499 77.8943 82.2195 84.4856 96.8478 106.2084 120.9835		(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		
30.6788 27.0077 28.3802 24.2070 22.9593 20.1375 19.4736 20.5549 21.1214 24.2119 26.5521 30.2459		(65)

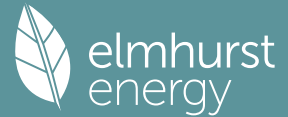
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts		
(66)m	Jan 60.9912 Feb 60.9912 Mar 60.9912 Apr 60.9912 May 60.9912 Jun 60.9912 Jul 60.9912 Aug 60.9912 Sep 60.9912 Oct 60.9912 Nov 60.9912 Dec 60.9912	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5		
8.7596 7.7802 6.3273 4.7902 3.5807 3.0230 3.2664 4.2459 5.6988 7.2359 8.4454 9.0031		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		
107.2202 108.3328 105.5291 99.5603 92.0257 84.9442 80.2134 79.1008 81.9045 87.8734 95.4079 102.4894		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		
42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156 42.1156		(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)		
-40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608 -40.6608		(71)
Water heating gains (Table 5)		
41.2349 40.1901 38.1454 33.6209 30.8593 27.9687 26.1741 27.6275 29.3353 32.5429 36.8779 40.6530		(72)
Total internal gains		
219.6608 218.7492 212.4478 200.4174 188.9117 178.3820 172.1000 173.4202 179.3846 190.0982 203.1773 214.5916		(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	
South	1.5000	46.7521	0.6300	0.7000	0.7700	21.4321 (78)

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East	0.3400	26.0000	0.6300	0.7000	1.0000	3.5086 (82)
West	0.3400	26.0000	0.6300	0.7000	1.0000	3.5086 (82)

Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107	24.1870 (83)
Total gains	248.1101	268.4235	283.0689	291.4348	293.3901	283.0376	272.6244	263.8790	257.1286	245.7700	237.4880	238.7786 (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	40.2621	40.4146	40.5651	41.2877	41.4257	42.0807	42.0807	42.2043	41.8260	41.4257	41.1474	40.8604
alpha	3.6841	3.6943	3.7043	3.7525	3.7617	3.8054	3.8054	3.8136	3.7884	3.7617	3.7432	3.7240
util living area	0.9736	0.9627	0.9416	0.8970	0.8117	0.6619	0.5070	0.5402	0.7414	0.9013	0.9593	0.9767 (86)
MIT	19.3820	19.5732	19.8877	20.2940	20.6448	20.8867	20.9685	20.9596	20.8154	20.3827	19.8266	19.3589 (87)
Th 2	19.4053	19.4102	19.4150	19.4377	19.4420	19.4619	19.4619	19.4656	19.4542	19.4420	19.4333	19.4244 (88)
util rest of house	0.9644	0.9498	0.9205	0.8578	0.7372	0.5347	0.3410	0.3747	0.6258	0.8556	0.9428	0.9686 (89)
MIT 2	17.6574	17.8982	18.2889	18.7894	19.1763	19.4085	19.4550	19.4556	19.3524	18.9069	18.2343	17.6412 (90)
Living area fraction									fLA = Living area / (4) =			0.8456 (91)
MIT	19.1158	19.3147	19.6409	20.0618	20.4182	20.6585	20.7349	20.7274	20.5895	20.1549	19.5808	19.0938 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1158	19.3147	19.6409	20.0618	20.4182	20.6585	20.7349	20.7274	20.5895	20.1549	19.5808	19.0938 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9624	0.9489	0.9240	0.8752	0.7868	0.6364	0.4801	0.5128	0.7144	0.8789	0.9447	0.9664 (94)
Useful gains	238.7728	254.7102	261.5607	255.0643	230.8372	180.1162	130.8913	135.3286	183.6900	216.0176	224.3510	230.7669 (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	508.8795	493.2341	447.9794	373.8516	291.0323	199.0992	135.8841	141.7943	214.5628	318.9653	419.4556	504.0682 (97)
Space heating kWh	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362 (98a)
Space heating requirement - total per year (kWh/year)												1050.6595
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	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1050.6595
Space heating per m2										(98c) / (4) =		57.9195 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362 (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	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	7.6673	6.1510	5.5383	4.0576	3.1342	2.5607	2.8591	3.7164	4.8272	6.3335	7.1537	7.8804 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-18.7764	-30.6188	-50.7351	-62.0241	-67.4669	-57.2599	-56.0073	-51.9678	-43.5488	-35.9691	-21.5786	-15.6512 (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	-4.9786	-12.7591	-32.2473	-61.0447	-93.8744	-104.9327	-102.5519	-80.5516	-51.7816	-22.0381	-7.3552	-3.7059 (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												1050.6595 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												1182.1211 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	61.8792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1089.4251 (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	1205.2347 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1050.6595	16.4900	173.2538 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1182.1211	16.4900	194.9318 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	61.8792	16.4900	10.2039 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-511.6040	16.4900	-84.3635
PV Unit electricity exported	-577.8210	5.5900	-32.3002
Total			-116.6637 (252)
Total energy cost			261.7257 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.4923 (257)
SAP value		75.8105
SAP rating (Section 12)		76 (258)
SAP band		C

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1050.6595	0.1547	162.5371 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1182.1211	0.1416	167.3823 (264)
Space and water heating			329.9194 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	61.8792	0.1443	8.9311 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-511.6040	0.1337	-68.4198
PV Unit electricity exported	-577.8210	0.1199	-69.2522
Total			-137.6720 (269)
Total CO2, kg/year			201.1785 (272)
CO2 emissions per m2			11.0900 (273)
EI value			95.7305
EI rating			96 (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

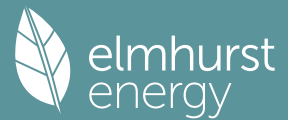
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling	18.1400 (1b)	x 3.0300 (2b)	= 54.9642 (1b) - (3b)
Ground floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	54.9642 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.3639 (8)
Pressure Test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Shelter factor
Infiltration rate adjusted to include shelter factor

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000	(22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000	(22a)
Adj infilt rate	0.5233	0.4876	0.4876	0.4639	0.4639	0.4044	0.4044	0.3925	0.4044	0.4520	0.4401	0.4758	(22b)
Effective ac	0.6369	0.6189	0.6189	0.6076	0.6076	0.5818	0.5818	0.5770	0.5818	0.6021	0.5968	0.6132	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Opening Type 1			2.2100	1.4000	3.0940			(26a)
Opening Type 2			1.5000	1.3258	1.9886			(27)
Opening Type 3			0.6800	1.3258	0.9015			(27a)
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000	(28a)
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000	(29a)
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400	(30)
Total net area of external elements Aum (A, m2)			87.8100					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 18.6540			(33)
Main dwelling								
Internal Wall 1			16.1500			9.0000	145.3500	(32c)
Heat capacity Cm = Sum(A x k)								
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)				2.3000	0.0500	0.1150		
E3 Sill				1.2500	0.0240	0.0300		
E4 Jamb				6.6000	0.0190	0.1254		
E5 Ground floor (normal)				17.7300	0.0410	0.7269		
E16 Corner (normal)				12.1200	0.0400	0.4848		
R1 Head of roof window				0.9000	0.2400	0.2160		
R2 Sill of roof window				0.9000	0.2400	0.2160		
R3 Jamb of roof window				3.0000	0.2400	0.7200		
E11 Eaves (insulation at rafter level)				11.2000	0.0200	0.2240		
E13 Gable (insulation at rafter level)				7.8000	0.0550	0.4290		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.2871	(36)
Point Thermal bridges							0.0000	
Total fabric heat loss							(33) + (36) + (36a) = 21.9411	(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	11.5529	11.2257	11.2257	11.0204	11.0204	10.5522	10.5522	10.4662	10.5522	10.9217	10.8254	11.1218	(38)
Average = Sum(39)m / 12 =	33.4939	33.1668	33.1668	32.9615	32.9615	32.4932	32.4932	32.4073	32.4932	32.8627	32.7665	33.0629	(39)
												32.8608	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.8464	1.8284	1.8284	1.8171	1.8171	1.7912	1.7912	1.7865	1.7912	1.8116	1.8063	1.8226	(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												1.0165	(42)
Hot water usage for mixer showers													
66.1170	65.1234	63.6755	60.9053	58.8609	56.5810	55.2851	56.7220	58.2972	60.7451	63.5748	65.8637	(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	(42b)	
Hot water usage for other uses													
25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402	(42c)	
Average daily hot water use (litres/day)												83.7215	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.1572	89.2530	86.8946	83.2138	80.2588	77.0684	75.7725	78.1200	80.6057	83.9641	87.7045	90.9039	(44)
Energy content (annual)	144.3707	127.0951	133.5538	113.9155	108.0438	94.7646	91.6403	96.7289	99.3949	113.9385	124.9511	142.3335	(45)
Distribution loss (46)m = 0.15 x (45)m												1390.7307	
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	(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													
122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835	(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	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835	(64)
Total per year (kWh/year) = Sum(64)m =												1182.1211	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
30.6788	27.0077	28.3802	24.2070	22.9593	20.1375	19.4736	20.5549	21.1214	24.2119	26.5521	30.2459	(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	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	8.7596	7.7802	6.3273	4.7902	3.5807	3.0230	3.2664	4.2459	5.6988	7.2359	8.4454	9.0031 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.2202	108.3328	105.5291	99.5603	92.0257	84.9442	80.2134	79.1008	81.9045	87.8734	95.4079	102.4894 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156 (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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608 (71)
Water heating gains (Table 5)	41.2349	40.1901	38.1454	33.6209	30.8593	27.9687	26.1741	27.6275	29.3353	32.5429	36.8779	40.6530 (72)
Total internal gains	219.6608	218.7492	212.4478	200.4174	188.9117	178.3820	172.1000	173.4202	179.3846	190.0982	203.1773	214.5916 (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		
South				1.5000	54.0600	0.6300	0.7000	0.7700		24.7822 (78)		
East				0.3400	32.0000	0.6300	0.7000	1.0000		4.3183 (82)		
West				0.3400	32.0000	0.6300	0.7000	1.0000		4.3183 (82)		
Solar gains	33.4187	51.0164	72.1834	94.9244	106.6642	113.2658	107.6202	98.3422	84.8598	61.4077	39.7065	28.5762 (83)
Total gains	253.0795	269.7656	284.6313	295.3418	295.5759	291.6478	279.7202	271.7624	264.2445	251.5059	242.8837	243.1678 (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	41.2877	41.6949	41.6949	41.9546	41.9546	42.5592	42.5592	42.6721	42.5592	42.0807	42.2043	41.8260
alpha	3.7525	3.7797	3.7797	3.7970	3.7970	3.8373	3.8373	3.8448	3.8373	3.8054	3.8136	3.7884
util living area	0.9681	0.9565	0.9286	0.8722	0.7599	0.5643	0.3881	0.4196	0.6749	0.8710	0.9482	0.9714 (86)
MIT	19.5559	19.7399	20.0646	20.4338	20.7586	20.9462	20.9905	20.9870	20.8855	20.5243	20.0016	19.5416 (87)
Th 2	19.4377	19.4502	19.4502	19.4581	19.4581	19.4761	19.4761	19.4795	19.4761	19.4619	19.4656	19.4542 (88)
util rest of house	0.9569	0.9413	0.9026	0.8239	0.6682	0.4219	0.2174	0.2471	0.5436	0.8120	0.9271	0.9613 (89)
MIT 2	17.8963	18.1320	18.5278	18.9627	19.2984	19.4577	19.4753	19.4779	19.4235	19.0775	18.4705	17.8902 (90)
Living area fraction	19.2998	19.4917	19.8274	20.2067	20.5332	20.7164	20.7566	20.7541	20.6599	20.3010	19.7652	19.2867 (92)
MIT	19.2998	19.4917	19.8274	20.2067	20.5332	20.7164	20.7566	20.7541	20.6599	20.3010	19.7652	19.2867 (93)
Temperature adjustment												0.0000
adjusted MIT	19.2998	19.4917	19.8274	20.2067	20.5332	20.7164	20.7566	20.7541	20.6599	20.3010	19.7652	19.2867 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9557	0.9418	0.9098	0.8494	0.7350	0.5397	0.3617	0.3928	0.6486	0.8471	0.9319	0.9599 (94)
Useful gains	241.8592	254.0547	258.9636	250.8752	217.2452	157.3947	101.1760	106.7495	171.3781	213.0519	226.3514	233.4193 (95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)
Heat loss rate W	482.3047	464.0601	415.4940	346.3166	258.1936	166.2488	102.5695	108.6967	190.4060	292.5097	392.0595	475.6666 (97)
Space heating kWh	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320 (98a)
Space heating requirement - total per year (kWh/year)												894.3156
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	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												894.3156
Space heating per m2										(98c) / (4) =		49.3008 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320 (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)

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Water heating												
Water heating requirement												
	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (64)
Efficiency of water heater												
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000 (216)
Fuel for water heating, kWh/month												
	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting												
	7.6673	6.1510	5.5383	4.0576	3.1342	2.5607	2.8591	3.7164	4.8272	6.3335	7.1537	7.8804 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-22.1993	-31.9706	-52.0052	-63.3034	-66.8538	-59.7681	-58.2206	-54.8601	-46.7036	-39.0705	-24.9484	-18.6459 (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	-6.8137	-14.3304	-35.7877	-68.4614	-100.9658	-118.4522	-114.3875	-92.5569	-60.6847	-27.3598	-9.8687	-5.1269 (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												894.3156 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												100.0000
Water heating fuel used												1182.1211 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												61.8792 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1193.3452 (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												944.9707 (238)

10a. Fuel costs - using BEDF prices (583)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	894.3156	28.4300	254.2539 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1182.1211	28.4300	336.0770 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	61.8792	28.4300	17.5922 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-538.5494	28.4300	-153.1096
PV Unit electricity exported	-654.7957	5.8100	-38.0436
Total			-191.1532 (252)
Total energy cost			416.7700 (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	894.3156	0.1552	138.8388 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1182.1211	0.1416	167.3823 (264)
Space and water heating			306.2211 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	61.8792	0.1443	8.9311 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-538.5494	0.1340	-72.1646
PV Unit electricity exported	-654.7957	0.1201	-78.6365
Total			-150.8010 (269)
Total CO2, kg/year			164.3512 (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	894.3156	1.5748	1408.3301 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1182.1211	1.5236	1801.0808 (278)
Space and water heating			3209.4109 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	61.8792	1.5338	94.9123 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-538.5494	1.4952	-805.2497
PV Unit electricity exported	-654.7957	0.4404	-288.3895
Total			-1093.6392 (283)
Total Primary energy kWh/year			2210.6840 (286)

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SAP 10 EPC IMPROVEMENTS

Proposed

Current energy efficiency rating: C 76
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 5.3	-£ 108	-55 kg (33.8%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£108	3.06 kg/m ²	B 81	A 97
Total Savings	£108	3.06 kg/m ²		

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 583 TEST (01 Oct 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £608	Potential £483	Saving £125
Electricity			
Space heating	£254	£277	-£23
Water heating	£336	£188	£148
Lighting	£18	£18	£0
Generated (PV)	-£191	-£174	-£17
Total cost of fuels	£417	£309	£108
Total cost of uses	£417	£309	£108
Delivered energy	52 kWh/m ²	28 kWh/m ²	24 kWh/m ²
Carbon dioxide emissions	0.2 tonnes	0.1 tonnes	0.1 tonnes
CO2 emissions per m ²	9 kg/m ²	6 kg/m ²	3 kg/m ²
Primary energy	122 kWh/m ²	90 kWh/m ²	31 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	18.1400 (1b)	x 3.0300 (2b)	= 54.9642 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	54.9642 (5)

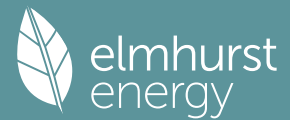
2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.3639 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.6139	(18)
Number of sides sheltered	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4758 (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	0.6066	0.5947	0.5828	0.5233	0.5114	0.4520	0.4520	0.4401	0.4758	0.5114	0.5352	0.5590 (22b)
Effective ac	0.6840	0.6768	0.6698	0.6369	0.6308	0.6021	0.6021	0.5968	0.6132	0.6308	0.6432	0.6562 (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								
Opening Type 1			2.2100	1.4000	3.0940			(26a)
Opening Type 2			1.5000	1.3258	1.9886			(27)
Opening Type 3			0.6800	1.3258	0.9015			(27a)
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000	(28a)
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000	(29a)
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400	(30)
Total net area of external elements Aum(A, m2)			87.8100					(31)
Fabric heat loss, W/K = Sum (A x U)					18.6540			(33)
Main dwelling								
Internal Wall 1			16.1500			9.0000	145.3500	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 4978.3900 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 274.4427 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	2.3000	0.0500	0.1150
E3 Sill	1.2500	0.0240	0.0300
E4 Jamb	6.6000	0.0190	0.1254
E5 Ground floor (normal)	17.7300	0.0410	0.7269
E16 Corner (normal)	12.1200	0.0400	0.4848
R1 Head of roof window	0.9000	0.2400	0.2160
R2 Sill of roof window	0.9000	0.2400	0.2160
R3 Jamb of roof window	3.0000	0.2400	0.7200
E11 Eaves (insulation at rafter level)	11.2000	0.0200	0.2240
E13 Gable (insulation at rafter level)	7.8000	0.0550	0.4290

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.2871 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 21.9411 (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	12.4060	12.2764	12.1494	11.5529	11.4412	10.9217	10.9217	10.8254	11.1218	11.4412	11.6670	11.9031
Average = Sum(39)m / 12 =	34.3471	34.2175	34.0905	33.4939	33.3823	32.8627	32.8627	32.7665	33.0629	33.3823	33.6081	33.8442

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.8934	1.8863	1.8793	1.8464	1.8403	1.8116	1.8116	1.8063	1.8226	1.8403	1.8527	1.8657
HLP (average)												1.8464
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.0165 (42)
Hot water usage for mixer showers													
66.1170 65.1234	63.6755	60.9053	58.8609	56.5810	55.2851	56.7220	58.2972	60.7451	63.5748	65.8637			(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	(42b)
Hot water usage for other uses	25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402	(42c)
Average daily hot water use (litres/day)													83.7215 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	91.1572	89.2530	86.8946	83.2138	80.2588	77.0684	75.7725	78.1200	80.6057	83.9641	87.7045	90.9039 (44)
Energy conte	144.3707	127.0951	133.5538	113.9155	108.0438	94.7646	91.6403	96.7289	99.3949	113.9385	124.9511	142.3335 (45)
Energy content (annual)										Total = Sum(45)m =		1390.7307
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

Water storage loss:
Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 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
122.7151 108.0309 113.5207 96.8282 91.8372 80.5499 77.8943 82.2195 84.4856 96.8478 106.2084 120.9835 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

Effective solar volume 75.0000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient 1.3161 (H16)

Heat delivered to hot water 471.7521 (H24)

Heat delivered to space heating 0.0000 (H29)

Solar input 471.7521

Solar input -0.0000 -16.6065 -50.3002 -62.7622 -74.3896 -66.4442 -64.6698 -61.0360 -47.0892 -27.7732 -0.6812 -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 122.7151 91.4244 63.2205 34.0660 17.4476 14.1057 13.2245 21.1835 37.3965 69.0745 105.5272 120.9835 (64)

Total per year (kWh/year) = Sum(64)m = 710.3690 (64)

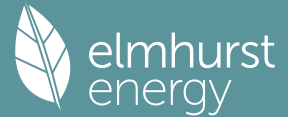
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

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

Heat gains from water heating, kWh/month
30.6788 27.0077 28.3802 24.2070 22.9593 20.1375 19.4736 20.5549 21.1214 24.2119 26.5521 30.2459 (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	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	8.7596	7.7802	6.3273	4.7902	3.5807	3.0230	3.2664	4.2459	5.6988	7.2359	8.4454	9.0031	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.2202	108.3328	105.5291	99.5603	92.0257	84.9442	80.2134	79.1008	81.9045	87.8734	95.4079	102.4894	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	(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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	(71)
Water heating gains (Table 5)	41.2349	40.1901	38.1454	33.6209	30.8593	27.9687	26.1741	27.6275	29.3353	32.5429	36.8779	40.6530	(72)
Total internal gains	219.6608	218.7492	212.4478	200.4174	188.9117	178.3820	172.1000	173.4202	179.3846	190.0982	203.1773	214.5916	(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
South				1.5000	46.7521	0.6300	0.7000			0.7700			21.4321 (78)
East				0.3400	26.0000	0.6300	0.7000			1.0000			3.5086 (82)
West				0.3400	26.0000	0.6300	0.7000			1.0000			3.5086 (82)
Solar gains	28.4493	49.6744	70.6210	91.0174	104.4784	104.6557	100.5244	90.4587	77.7439	55.6717	34.3107	24.1870	(83)
Total gains	248.1101	268.4235	283.0689	291.4348	293.3901	283.0376	272.6244	263.8790	257.1286	245.7700	237.4880	238.7786	(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	40.2621	40.4146	40.5651	41.2877	41.4257	42.0807	42.0807	42.2043	41.8260	41.4257	41.1474	40.8604	
alpha	3.6841	3.6943	3.7043	3.7525	3.7617	3.8054	3.8054	3.8136	3.7884	3.7617	3.7432	3.7240	
util living area	0.9736	0.9627	0.9416	0.8970	0.8117	0.6619	0.5070	0.5402	0.7414	0.9013	0.9593	0.9767	(86)
MIT	19.3820	19.5732	19.8877	20.2940	20.6448	20.8867	20.9685	20.9596	20.8154	20.3827	19.8266	19.3589	(87)
Th 2	19.4053	19.4102	19.4150	19.4377	19.4420	19.4619	19.4619	19.4656	19.4542	19.4420	19.4333	19.4244	(88)
util rest of house	0.9644	0.9498	0.9205	0.8578	0.7372	0.5347	0.3410	0.3747	0.6258	0.8556	0.9428	0.9686	(89)
MIT 2	17.6574	17.8982	18.2889	18.7894	19.1763	19.4085	19.4550	19.4556	19.3524	18.9069	18.2343	17.6412	(90)
Living area fraction	19.1158	19.3147	19.6409	20.0618	20.4182	20.6585	20.7349	20.7274	20.5895	20.1549	19.5808	19.0938	(91)
MIT	19.1158	19.3147	19.6409	20.0618	20.4182	20.6585	20.7349	20.7274	20.5895	20.1549	19.5808	19.0938	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1158	19.3147	19.6409	20.0618	20.4182	20.6585	20.7349	20.7274	20.5895	20.1549	19.5808	19.0938	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9624	0.9489	0.9240	0.8752	0.7868	0.6364	0.4801	0.5128	0.7144	0.8789	0.9447	0.9664	(94)
Useful gains	238.7728	254.7102	261.5607	255.0643	230.8372	180.1162	130.8913	135.3286	183.6900	216.0176	224.3510	230.7669	(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	508.8795	493.2341	447.9794	373.8516	291.0323	199.0992	135.8841	141.7943	214.5628	318.9653	419.4556	504.0682	(97)
Space heating kWh	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362	(98a)
Space heating requirement - total per year (kWh/year)												1050.6595	
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	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1050.6595	
Space heating per m2										(98c) / (4) =		57.9195	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	200.9594	160.2881	138.6955	85.5268	44.7851	0.0000	0.0000	0.0000	0.0000	76.5931	140.4753	203.3362	(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	122.7151	91.4244	63.2205	34.0660	17.4476	14.1057	13.2245	21.1835	37.3965	69.0745	105.5272	120.9835	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													

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	122.7151	91.4244	63.2205	34.0660	17.4476	14.1057	13.2245	21.1835	37.3965	69.0745	105.5272	120.9835	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	7.6673	6.1510	5.5383	4.0576	3.1342	2.5607	2.8591	3.7164	4.8272	6.3335	7.1537	7.8804	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.8120	-30.4572	-49.0153	-56.9079	-56.5014	-42.9728	-42.2498	-41.5965	-38.4642	-35.2198	-21.6346	-15.6782	(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	-4.9429	-12.9207	-33.9671	-66.1609	-104.8399	-119.2198	-116.3094	-90.9229	-56.8662	-22.7875	-7.2992	-3.6788	(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												1050.6595	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												710.3690	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												61.8792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1089.4251	(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												813.4826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1050.6595	16.4900	173.2538	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	710.3690	16.4900	117.1398	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	61.8792	16.4900	10.2039	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.5097	16.4900	-74.1242	
PV Unit electricity exported	-639.9154	5.5900	-35.7713	
Total			-109.8954	(252)
Total energy cost			203.8941	(255)

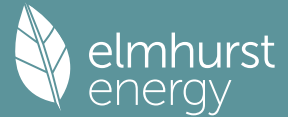
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		1.1625	(257)
SAP value		81.1555	
SAP rating (Section 12)		81	(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	1050.6595	0.1547	162.5371	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	710.3690	0.1501	106.6223	(264)
Space and water heating			269.1594	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	61.8792	0.1443	8.9311	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-449.5097	0.1354	-60.8450	
PV Unit electricity exported	-639.9154	0.1190	-76.1668	
Total			-137.0118	(269)
Total CO2, kg/year			152.1756	(272)
CO2 emissions per m2			8.3900	(273)
EI value			96.7704	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	18.1400 (1b)	x 3.0300 (2b)	= 54.9642 (1b) - (3b)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	18.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 54.9642 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.3639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.6139 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4758 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.5233	0.4876	0.4876	0.4639	0.4639	0.4044	0.4044	0.3925	0.4044	0.4520	0.4401	0.4758 (22b)
Effective ac	0.6369	0.6189	0.6189	0.6076	0.6076	0.5818	0.5818	0.5770	0.5818	0.6021	0.5968	0.6132 (25)

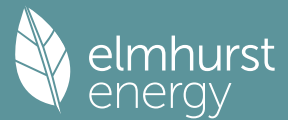
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Main dwelling												
Opening Type 1			2.2100	1.4000	3.0940		(26a)					
Opening Type 2			1.5000	1.3258	1.9886		(27)					
Opening Type 3			0.6800	1.3258	0.9015		(27a)					
Heatloss Floor 1			18.1400	0.1100	1.9954	110.0000	1995.4000 (28a)					
External Wall 1	47.8300	3.7100	44.1200	0.1700	7.5004	60.0000	2647.2000 (29a)					
External Roof 1	21.8400	0.6800	21.1600	0.1500	3.1740	9.0000	190.4400 (30)					
Total net area of external elements Aum(A, m2)			87.8100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	18.6540		(33)					
Main dwelling												
Internal Wall 1			16.1500			9.0000	145.3500 (32c)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4978.3900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							274.4427 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				2.3000	0.0500	0.1150						
E3 Sill				1.2500	0.0240	0.0300						
E4 Jamb				6.6000	0.0190	0.1254						
E5 Ground floor (normal)				17.7300	0.0410	0.7269						
E16 Corner (normal)				12.1200	0.0400	0.4848						
R1 Head of roof window				0.9000	0.2400	0.2160						
R2 Sill of roof window				0.9000	0.2400	0.2160						
R3 Jamb of roof window				3.0000	0.2400	0.7200						
E11 Eaves (insulation at rafter level)				11.2000	0.0200	0.2240						
E13 Gable (insulation at rafter level)				7.8000	0.0550	0.4290						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.2871 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	21.9411 (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	11.5529	11.2257	11.2257	11.0204	11.0204	10.5522	10.5522	10.4662	10.5522	10.9217	10.8254	11.1218 (38)
Average = Sum(39)m / 12 =	33.4939	33.1668	33.1668	32.9615	32.9615	32.4932	32.4932	32.4073	32.4932	32.8627	32.7665	33.0629 (39)
												32.8608
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8464	1.8284	1.8284	1.8171	1.8171	1.7912	1.7912	1.7865	1.7912	1.8116	1.8063	1.8226 (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												1.0165 (42)
Hot water usage for mixer showers												
Hot water usage for baths	66.1170	65.1234	63.6755	60.9053	58.8609	56.5810	55.2851	56.7220	58.2972	60.7451	63.5748	65.8637 (42a)
Hot water usage for other uses	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	25.0402	24.1296	23.2191	22.3085	21.3980	20.4874	20.4874	21.3980	22.3085	23.2191	24.1296	25.0402 (42c)

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Average daily hot water use (litres/day)												83.7215 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content	91.1572	89.2530	86.8946	83.2138	80.2588	77.0684	75.7725	78.1200	80.6057	83.9641	87.7045	90.9039 (44)
Energy content (annual)	144.3707	127.0951	133.5538	113.9155	108.0438	94.7646	91.6403	96.7289	99.3949	113.9385	124.9511	142.3335 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1390.7307
Distribution 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)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
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	122.7151	108.0309	113.5207	96.8282	91.8372	80.5499	77.8943	82.2195	84.4856	96.8478	106.2084	120.9835 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												520.5677 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												520.5677
Solar input	-3.0966	-19.1516	-53.5811	-66.7637	-76.6814	-70.8432	-68.3044	-66.3125	-53.1500	-34.8350	-7.8481	-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	119.6185	88.8793	59.9396	30.0644	15.1559	9.7067	9.5898	15.9070	31.3356	62.0128	98.3603	120.9835 (64)
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											661.5534 (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	30.6788	27.0077	28.3802	24.2070	22.9593	20.1375	19.4736	20.5549	21.1214	24.2119	26.5521	30.2459 (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	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912	60.9912 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	8.7596	7.7802	6.3273	4.7902	3.5807	3.0230	3.2664	4.2459	5.6988	7.2359	8.4454	9.0031 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	107.2202	108.3328	105.5291	99.5603	92.0257	84.9442	80.2134	79.1008	81.9045	87.8734	95.4079	102.4894 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156	42.1156 (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)	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608	-40.6608 (71)
Water heating gains (Table 5)	41.2349	40.1901	38.1454	33.6209	30.8593	27.9687	26.1741	27.6275	29.3353	32.5429	36.8779	40.6530 (72)
Total internal gains	219.6608	218.7492	212.4478	200.4174	188.9117	178.3820	172.1000	173.4202	179.3846	190.0982	203.1773	214.5916 (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	
South				1.5000	54.0600	0.6300	0.7000		0.7700		24.7822 (78)	
East				0.3400	32.0000	0.6300	0.7000		1.0000		4.3183 (82)	
West				0.3400	32.0000	0.6300	0.7000		1.0000		4.3183 (82)	
Solar gains	33.4187	51.0164	72.1834	94.9244	106.6642	113.2658	107.6202	98.3422	84.8598	61.4077	39.7065	28.5762 (83)
Total gains	253.0795	269.7656	284.6313	295.3418	295.5759	291.6478	279.7202	271.7624	264.2445	251.5059	242.8837	243.1678 (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	41.2877	41.6949	41.6949	41.9546	41.9546	42.5592	42.5592	42.6721	42.5592	42.0807	42.2043	41.8260
alpha	3.7525	3.7797	3.7797	3.7970	3.7970	3.8373	3.8373	3.8448	3.8373	3.8054	3.8136	3.7884
util living area	0.9681	0.9565	0.9286	0.8722	0.7599	0.5643	0.3881	0.4196	0.6749	0.8710	0.9482	0.9714 (86)
MIT	19.5559	19.7399	20.0646	20.4338	20.7586	20.9462	20.9905	20.9870	20.8855	20.5243	20.0016	19.5416 (87)
Th 2	19.4377	19.4502	19.4502	19.4581	19.4581	19.4761	19.4761	19.4795	19.4761	19.4619	19.4656	19.4542 (88)
util rest of house	0.9569	0.9413	0.9026	0.8239	0.6682	0.4219	0.2174	0.2471	0.5436	0.8120	0.9271	0.9613 (89)
MIT 2	17.8963	18.1320	18.5278	18.9627	19.2984	19.4577	19.4753	19.4779	19.4235	19.0775	18.4705	17.8902 (90)
Living area fraction	fLA = Living area / (4) = 0.8456 (91)											
MIT	19.2998	19.4917	19.8274	20.2067	20.5332	20.7164	20.7566	20.7541	20.6599	20.3010	19.7652	19.2867 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.2998	19.4917	19.8274	20.2067	20.5332	20.7164	20.7566	20.7541	20.6599	20.3010	19.7652	19.2867 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9557	0.9418	0.9098	0.8494	0.7350	0.5397	0.3617	0.3928	0.6486	0.8471	0.9319	0.9599	(94)
Useful gains	241.8592	254.0547	258.9636	250.8752	217.2452	157.3947	101.1760	106.7495	171.3781	213.0519	226.3514	233.4193	(95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W	482.3047	464.0601	415.4940	346.3166	258.1936	166.2488	102.5695	108.6967	190.4060	292.5097	392.0595	475.6666	(97)
Space heating kWh	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320	(98a)
Space heating requirement - total per year (kWh/year)												894.3156	
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	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												894.3156	
Space heating per m2										(98c) / (4) =		49.3008	(99)

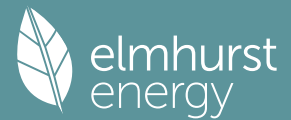
9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	178.8915	141.1237	116.4586	68.7179	30.4656	0.0000	0.0000	0.0000	0.0000	59.1166	119.3099	180.2320	(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	119.6185	88.8793	59.9396	30.0644	15.1559	9.7067	9.5898	15.9070	31.3356	62.0128	98.3603	120.9835	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	119.6185	88.8793	59.9396	30.0644	15.1559	9.7067	9.5898	15.9070	31.3356	62.0128	98.3603	120.9835	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	7.6673	6.1510	5.5383	4.0576	3.1342	2.5607	2.8591	3.7164	4.8272	6.3335	7.1537	7.8804	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-22.2269	-31.7336	-49.8255	-56.8150	-53.9664	-42.7860	-42.2055	-41.9700	-39.8974	-37.7454	-24.9312	-18.6848	(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	-6.7860	-14.5674	-37.9675	-74.9498	-113.8532	-135.4342	-130.4025	-105.4470	-67.4909	-28.6849	-9.8859	-5.0880	(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												894.3156	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												661.5534	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												61.8792	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1193.3452	(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												504.4030	(238)

10a. Fuel costs - using BEDF prices (583)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	894.3156	28.4300	254.2539	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	661.5534	28.4300	188.0796	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	28.4300	22.7440	(249)
Energy for lighting	61.8792	28.4300	17.5922	(250)
Additional standing charges			0.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-462.7877	28.4300	-131.5705
PV Unit electricity exported	-730.5575	5.8100	-42.4454
Total			-174.0159 (252)
Total energy cost			308.6539 (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	894.3156	0.1552	138.8388 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	661.5534	0.1512	100.0293 (264)
Space and water heating			238.8681 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	61.8792	0.1443	8.9311 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-462.7877	0.1359	-62.9026
PV Unit electricity exported	-730.5575	0.1192	-87.1118
Total			-150.0144 (269)
Total CO2, kg/year			108.8818 (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	894.3156	1.5748	1408.3301 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	661.5534	1.5595	1031.6952 (278)
Space and water heating			2440.0252 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	61.8792	1.5338	94.9123 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-462.7877	1.5025	-695.3221
PV Unit electricity exported	-730.5575	0.4372	-319.4211
Total			-1014.7433 (283)
Total Primary energy kWh/year			1641.2183 (286)