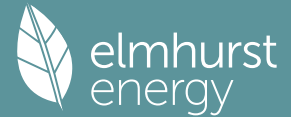


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Property Reference	RADESIGN-7007-23		Issued on Date	19/09/2023	
Assessment Reference	SEC1 ASHP actis	Prop Type Ref	DS		
Property	Proposed dwelling , Sunnyside Farm, Cambrose, Redruth, Cornwall, TR16 4HT				
SAP Rating	94 A	DER	0.20	TER	9.15
Environmental	100 A	% DER < TER			97.81
CO ₂ Emissions (t/year)	-0.13	DFEE	44.30	TFEE	45.12
Compliance Check	See BREL	% DFEE < TFEE			1.80
% DPER < TPER	72.80	DPER	13.12	TPER	48.24
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
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)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	575.6618 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (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
Window (U _w = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)

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10-12			2.3400	1.2357	2.8916			(27a)
13-15			2.3400	1.2357	2.8916			(27a)
25-29			3.8900	1.2357	4.8070			(27a)
30-31			1.5600	1.2357	1.9278			(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.6000	(28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800	(29a)
External Wall 2 Render	90.7700	11.2400	79.5300	0.1800	14.3154	9.0000	715.7700	(29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300	(30)
Total net area of external elements Aum(A, m2)			456.7800					(31)
Fabric heat loss, W/K = Sum(A x U)			(26)...(30) + (32) =	126.3213				(33)
Internal Wall 1 GF			118.5600			9.0000	1067.0400	(32c)
Internal Wall 2 FF			214.5800			9.0000	1931.2200	(32c)
Internal Floor 1			97.4600			18.0000	1754.2800	(32d)
Internal Ceiling 1			97.4600			9.0000	877.1400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 151.5313 (37)

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

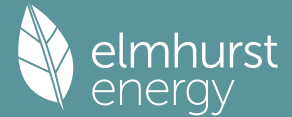
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.9287	48.3232	47.7177	44.6901	44.0845	41.0569	41.0569	40.4514	42.2680	44.0845	45.2956	46.5066
Average = Sum(39)m / 12 =	200.4600	199.8545	199.2489	196.2213	195.6158	192.5882	192.5882	191.9827	193.7992	195.6158	196.8269	198.0379

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0128	1.0098	1.0067	0.9914	0.9884	0.9731	0.9731	0.9700	0.9792	0.9884	0.9945	1.0006
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9992 (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	85.9543	84.6778	82.8801	79.5656	77.0837	74.3317	72.8452	74.6303	76.5739	79.5186	82.9014	85.6637	85.6637 (42b)
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449	45.3449 (42c)
Average daily hot water use (litres/day)													120.9158 (43)
Daily hot water use	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087	131.0087 (44)
Energy conte	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279	205.1279 (45)
Energy content (annual)													Total = Sum(45)m = 2007.9821
Distribution loss (46)m = 0.15 x (45)m	31.1919	27.4204	28.8013	24.6337	23.3900	20.5528	19.9455	21.0581	21.6357	24.7445	27.0542	30.7692	30.7692 (46)
Water storage loss:													300.0000 (47)
Store volume													2.2000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													1.1880 (55)
Enter (49) or (54) in (55)													
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183	265.2183 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183	265.2183 (64)
Total per year (kWh/year) = Sum(64)m =													2715.4981 (64)
12Total per year (kWh/year)													2715 (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)

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Heat gains from water heating, kWh/month
 117.2143 104.2020 111.9152 101.1262 99.9202 92.0803 92.2847 94.7512 94.4808 102.9227 106.4917 116.2773 (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	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.1505	206.0952	186.1505	192.3555	186.1505	192.3555	186.1505	186.1505	192.3555	186.1505	192.3555	186.1505 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.0642	372.8940	363.2432	342.6978	316.7629	292.3877	276.1036	272.2739	281.9247	302.4701	328.4050	352.7801 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961 (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)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685 (71)
Water heating gains (Table 5)	157.5461	155.0625	150.4236	140.4531	134.3014	127.8894	124.0386	127.3538	131.2234	138.3370	147.9052	156.2868 (72)
Total internal gains	780.7491	802.0399	767.8055	743.4946	705.2029	680.6208	654.2810	653.7664	673.4918	694.9458	736.6539	763.2056 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	1.4400	19.6403	0.7600	0.7000	0.7700	10.4269 (76)						
South	10.3500	46.7521	0.7600	0.7000	0.7700	178.3964 (78)						
West	25.9800	19.6403	0.7600	0.7000	0.7700	188.1184 (80)						
North	3.8900	26.0000	0.7600	0.7000	1.0000	48.4258 (82)						
East	1.5600	26.0000	0.7600	0.7000	1.0000	19.4201 (82)						
South	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)						
West	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)						
Solar gains	503.0480	942.4772	1477.4268	2081.0369	2512.8365	2562.2118	2443.0544	2118.8317	1690.4738	1096.1114	619.0812	419.2800 (83)
Total gains	1283.7971	1744.5171	2245.2323	2824.5315	3218.0395	3242.8327	3097.3354	2772.5981	2363.9656	1791.0572	1355.7351	1182.4856 (84)

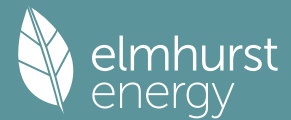
7. Mean internal temperature (heating season)

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	26.9341	27.0157	27.0978	27.5159	27.6011	28.0350	28.0350	28.1234	27.8598	27.6011	27.4313	27.2635
alpha	2.7956	2.8010	2.8065	2.8344	2.8401	2.8690	2.8690	2.8749	2.8573	2.8401	2.8288	2.8176
util living area	0.9566	0.9087	0.8220	0.6721	0.5106	0.3650	0.2687	0.3103	0.5114	0.7847	0.9257	0.9644 (86)
Living	19.1510	19.5494	20.0325	20.4982	20.7461	20.8525	20.8806	20.8744	20.7861	20.3712	19.6681	19.0887
Non living	17.8877	18.3876	18.9820	19.5413	19.8178	19.9374	19.9615	19.9601	19.8742	19.4140	18.5529	17.8161
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.0541	19.5494	20.0325	20.4982	20.7461	20.8525	20.8806	20.8744	20.7861	20.3712	19.6681	19.3560 (87)
Th 2	20.0727	20.0752	20.0777	20.0905	20.0930	20.1058	20.1058	20.1084	20.1007	20.0930	20.0879	20.0828 (88)
util rest of house	0.9506	0.8972	0.8017	0.6405	0.4702	0.3180	0.2158	0.2529	0.4567	0.7528	0.9144	0.9594 (89)
MIT 2	19.2016	18.3876	18.9820	19.5413	19.8178	19.9374	19.9615	19.9601	19.8742	19.4140	18.5529	18.2246 (90)
Living area fraction	fLA = Living area / (4) =											
LIT	19.4394	18.7117	19.2751	19.8083	20.0768	20.1927	20.2179	20.2152	20.1286	19.6811	18.8641	18.5403 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4394	18.7117	19.2751	19.8083	20.0768	20.1927	20.2179	20.2152	20.1286	19.6811	18.8641	18.5403 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9459	0.8767	0.7816	0.6301	0.4695	0.3226	0.2225	0.2599	0.4585	0.7365	0.8953	0.9488 (94)
Useful gains	1214.2930	1529.3630	1754.9786	1779.6644	1510.7716	1046.1969	689.2684	720.6385	1083.8905	1319.1877	1213.8338	1121.8949 (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	3034.8498	2760.3386	2545.4236	2140.4317	1638.6328	1077.0829	696.7663	732.4428	1168.3455	1776.3969	2315.4813	2839.9178 (97)
Space heating kWh	1354.4943	827.2156	588.0911	259.7525	95.1288	0.0000	0.0000	0.0000	0.0000	340.1636	793.1862	1278.2091 (98a)
Space heating requirement - total per year (kWh/year)	5536.2411											
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	1354.4943	827.2156	588.0911	259.7525	95.1288	0.0000	0.0000	0.0000	0.0000	340.1636	793.1862	1278.2091 (98c)

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Space heating requirement after solar contribution - total per year (kWh/year)
 Space heating per m2

5536.2411
 (98c) / (4) = 27.9721 (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 %) 274.1474 (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	1354.4943	827.2156	588.0911	259.7525	95.1288	0.0000	0.0000	0.0000	0.0000	340.1636	793.1862	1278.2091	(98)
Space heating efficiency (main heating system 1)	274.1474	274.1474	274.1474	274.1474	274.1474	0.0000	0.0000	0.0000	0.0000	274.1474	274.1474	274.1474	(210)
Space heating fuel (main heating system)	494.0753	301.7412	214.5164	94.7492	34.6999	0.0000	0.0000	0.0000	0.0000	124.0806	289.3284	466.2489	(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	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183	(64)
Efficiency of water heater (217)m	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	(216)
Fuel for water heating, kWh/month	142.0227	125.6189	133.5781	117.8292	114.4632	103.4139	102.2955	106.2260	107.2393	119.2479	126.3795	140.5295	(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	49.8657	45.0400	49.8657	48.2572	49.8657	48.2572	49.8657	49.8657	48.2572	49.8657	48.2572	49.8657	(231)
Lighting	43.1387	34.6074	31.1602	22.8293	17.6340	14.4071	16.0863	20.9096	27.1595	35.6347	40.2493	44.3376	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-97.4423	-137.7553	-196.2256	-211.9412	-220.0415	-198.8724	-196.6605	-186.6009	-166.8099	-150.7712	-105.6804	-83.4788	(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	-40.2956	-92.0896	-195.2266	-312.6819	-428.0862	-438.3404	-432.1312	-362.7775	-263.4636	-143.0549	-57.6966	-31.7842	(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												2019.4399	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.7278	
Water heating fuel used												1438.8437	(219)
Space cooling fuel												0.0000	(221)

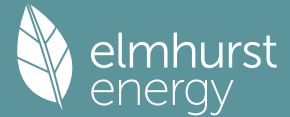
Electricity for pumps and fans:
 (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)
 mechanical ventilation fans (SFP = 0.8360) 587.1290 (230a)
 Total electricity for the above, kWh/year 587.1290 (231)
 Electricity for lighting (calculated in Appendix L) 348.1537 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 PV generation -4749.9083 (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 -356.3420 (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	2019.4399	0.1566	316.3255	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1438.8437	0.1408	202.5972	(264)
Space and water heating			518.9227	(265)
Pumps, fans and electric keep-hot	587.1290	0.1387	81.4420	(267)
Energy for lighting	348.1537	0.1443	50.2493	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1952.2800	0.1354	-264.3133	

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PV Unit electricity exported	-2797.6283	0.1241	-347.3163
Total			-611.6296 (269)
Total CO2, kg/year			38.9845 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.2000 (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	2019.4399	1.5798	3190.3632 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1438.8437	1.5206	2187.9678 (278)
Space and water heating			5378.3310 (279)
Pumps, fans and electric keep-hot	587.1290	1.5128	888.2087 (281)
Energy for lighting	348.1537	1.5338	534.0098 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1952.2800	1.5004	-2929.2513
PV Unit electricity exported	-2797.6283	0.4556	-1274.7017
Total			-4203.9530 (283)
Total Primary energy kWh/year			2596.5966 (286)
Dwelling Primary energy Rate (DPER)			13.1200 (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)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 575.6618 (5)

2. Ventilation rate

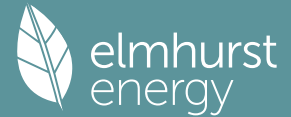
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0695 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3195 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2716 (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	0.3462	0.3395	0.3327	0.2987	0.2919	0.2580	0.2580	0.2512	0.2716	0.2919	0.3055	0.3191 (22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509 (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
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TER Semi-glazed door			2.1000	1.0000	2.1000	(26a)
TER Opening Type (Uw = 1.20)			37.3500	1.1450	42.7672	(27)
10-12			2.3100	1.5918	3.6770	(27a)
13-15			2.3100	1.5918	3.6770	(27a)
25-29			3.8500	1.5918	6.1283	(27a)
30-31			1.5400	1.5918	2.4513	(27a)
Floor 1 P/a 0.46			100.4600	0.1300	13.0598	(28a)
External Wall 1 Stone	149.5500	28.3200	121.2300	0.1800	21.8214	(29a)
External Wall 2 Render	90.7700	11.1300	79.6400	0.1800	14.3352	(29a)
External Roof 1	116.0000	10.0100	105.9900	0.1100	11.6589	(30)
Total net area of external elements Aum(A, m2)			456.7800			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	121.6760		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0900	2.5830
E5 Ground floor (normal)	46.5000	0.1600	7.4400
E6 Intermediate floor within a dwelling	42.5000	0.0000	0.0000
E13 Gable (insulation at rafter level)	19.8600	0.0800	1.5888
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0900	-0.7650
R4 Ridge (vaulted ceiling)	18.9600	0.0800	1.5168
R7 Flat ceiling (inverted)	3.2000	0.0400	0.1280
E11 Eaves (insulation at rafter level)	32.0700	0.0400	1.2828
E2 Other lintels (including other steel lintels)	22.9500	0.0500	1.1475
E3 Sill	21.9500	0.0500	1.0975
E4 Jamb	54.8000	0.0500	2.7400
R1 Head of roof window	8.5800	0.0800	0.6864
R2 Sill of roof window	8.5800	0.0600	0.5148
R3 Jamb of roof window	30.6800	0.0800	2.4544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.4150 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 144.0910 (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	106.3712	105.9291	105.4957	103.4599	103.0790	101.3060	101.3060	100.9776	101.9889	103.0790	103.8495	104.6551 (38)
Average = Sum(39)m / 12 =	250.4622	250.0201	249.5867	247.5509	247.1700	245.3970	245.3970	245.0686	246.0799	247.1700	247.9405	248.7461 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2655	1.2632	1.2610	1.2508	1.2488	1.2399	1.2399	1.2382	1.2433	1.2488	1.2527	1.2568 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9992 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	85.9543	84.6778	82.8801	79.5656	77.0837	74.3317	72.8452	74.6303	76.5739	79.5186	82.9014	85.6637 (42b)	
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449 (42c)	
Average daily hot water use (litres/day)													120.9158 (43)
Daily hot water use	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087 (44)	
Energy content (annual)	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279 (45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2007.9821
Water storage loss:	31.1919	27.4204	28.8013	24.6337	23.3900	20.5528	19.9455	21.0581	21.6357	24.7445	27.0542	30.7692 (46)	
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)	
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (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	266.5747	235.7576	250.6373	220.9620	214.5623	193.7563	191.5985	199.0164	200.9759	223.5924	237.0988	263.7567 (62)	
WVHRS	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	266.5747	235.7576	250.6373	220.9620	214.5623	193.7563	191.5985	199.0164	200.9759	223.5924	237.0988	263.7567 (64)	
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2698.2891 (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	116.0451	103.1459	110.7459	99.9947	98.7509	90.9488	91.1155	93.5819	93.3493	101.7534	105.3602	115.1081 (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	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.1505	206.0952	186.1505	192.3555	186.1505	192.3555	186.1505	186.1505	192.3555	186.1505	192.3555	186.1505 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.0642	372.8940	363.2432	342.6978	316.7629	292.3877	276.1036	272.2739	281.9247	302.4701	328.4050	352.7801 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685 (71)
Water heating gains (Table 5)	155.9745	153.4909	148.8520	138.8815	132.7298	126.3178	122.4670	125.7822	129.6518	136.7654	146.3336	154.7152 (72)
Total internal gains	782.1775	803.4683	769.2339	744.9230	706.6313	679.0492	652.7094	652.1948	671.9202	696.3742	738.0823	764.6340 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233 (76)						
South	10.2400	46.7521	0.6300	0.7000	0.7700	146.3095 (78)						
West	25.6900	19.6403	0.6300	0.7000	0.7700	154.1996 (80)						
North	3.8500	26.0000	0.6300	0.7000	1.0000	39.7297 (82)						
East	1.5400	26.0000	0.6300	0.7000	1.0000	15.8919 (82)						
South	2.3100	26.0000	0.6300	0.7000	1.0000	23.8378 (82)						
West	2.3100	26.0000	0.6300	0.7000	1.0000	23.8378 (82)						
Solar gains	412.3296	772.4781	1210.8635	1705.4775	2059.2886	2099.7287	2002.0887	1736.4265	1385.4396	898.3798	507.4310	343.6726 (83)
Total gains	1194.5071	1575.9464	1980.0973	2450.4005	2765.9199	2778.7780	2654.7981	2388.6213	2057.3598	1594.7540	1245.5133	1108.3066 (84)

7. Mean internal temperature (heating season)

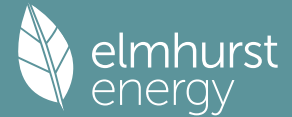
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature during heating periods in the living area from Table 9, Th1 (C)	21.5570	21.5951	21.6326	21.8105	21.8441	22.0019	22.0019	22.0314	21.9409	21.8441	21.7762	21.7057 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	2.4371	2.4397	2.4422	2.4540	2.4563	2.4668	2.4668	2.4688	2.4627	2.4563	2.4517	2.4470
util living area	0.9659	0.9357	0.8813	0.7778	0.6425	0.4954	0.3793	0.4298	0.6403	0.8546	0.9457	0.9711 (86)
MIT	17.9678	18.4446	19.1212	19.9040	20.4748	20.8041	20.9264	20.8983	20.6161	19.7841	18.7193	17.8850 (87)
Th 2	19.8680	19.8697	19.8715	19.8796	19.8811	19.8882	19.8882	19.8895	19.8855	19.8811	19.8780	19.8748 (88)
util rest of house	0.9605	0.9261	0.8638	0.7463	0.5933	0.4260	0.2926	0.3393	0.5725	0.8256	0.9359	0.9666 (89)
MIT 2	16.3331	16.9345	17.7784	18.7316	19.3890	19.7407	19.8490	19.8315	19.5674	18.6185	17.2947	16.2318 (90)
Living area fraction	16.7891	17.3558	18.1530	19.0587	19.6919	20.0374	20.1496	20.1292	19.8600	18.9437	17.6921	16.6930 (91)
Temperature adjustment	16.7891	17.3558	18.1530	19.0587	19.6919	20.0374	20.1496	20.1292	19.8600	18.9437	17.6921	16.6930 (92)
adjusted MIT	16.7891	17.3558	18.1530	19.0587	19.6919	20.0374	20.1496	20.1292	19.8600	18.9437	17.6921	16.6930 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9386	0.8963	0.8299	0.7196	0.5843	0.4358	0.3137	0.3597	0.5708	0.7952	0.9086	0.9469 (94)
Useful gains	1121.1381	1412.4857	1643.2802	1763.4040	1616.1785	1211.0784	832.8142	859.3022	1174.4068	1268.2037	1131.6996	1049.4198 (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	3128.0591	3114.2013	2908.4347	2514.7946	1975.3641	1334.3223	871.0692	913.8979	1417.4176	2062.3106	2626.2215	3107.5910 (97)
Space heating kWh	1493.1492	1143.5529	941.2750	541.0012	267.2341	0.0000	0.0000	0.0000	0.0000	590.8155	1076.0557	1531.2793 (98a)
Space heating requirement - total per year (kWh/year)												7584.3630
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	1493.1492	1143.5529	941.2750	541.0012	267.2341	0.0000	0.0000	0.0000	0.0000	590.8155	1076.0557	1531.2793 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7584.3630
Space heating per m ²										(98c) / (4) =		38.3203 (99)

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

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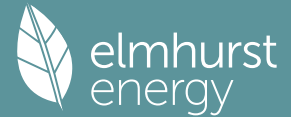
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (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	1493.1492	1143.5529	941.2750	541.0012	267.2341	0.0000	0.0000	0.0000	0.0000	590.8155	1076.0557	1531.2793	(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)	1617.7131	1238.9522	1019.7995	586.1335	289.5277	0.0000	0.0000	0.0000	0.0000	640.1035	1165.8242	1659.0242	(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	266.5747	235.7576	250.6373	220.9620	214.5623	193.7563	191.5985	199.0164	200.9759	223.5924	237.0988	263.7567	(64)
Efficiency of water heater													79.8000 (216)
Fuel for water heating, kWh/month	87.3083	87.1206	86.7428	85.9877	84.5532	79.8000	79.8000	79.8000	79.8000	86.1330	87.0278	87.3524	(217)
Space cooling fuel requirement	305.3256	270.6108	288.9431	256.9693	253.7601	242.8024	240.0984	249.3940	251.8495	259.5897	272.4403	301.9455	(219)
(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	38.6784	31.0293	27.9384	20.4689	15.8107	12.9175	14.4231	18.7477	24.3514	31.9503	36.0878	39.7534	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-83.6446	-113.0170	-155.7068	-167.4543	-174.2312	-160.1843	-157.9250	-151.9322	-140.7962	-125.2172	-90.0709	-72.8797	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.4486	-131.2057	-256.8212	-380.2566	-497.7804	-498.5653	-492.9441	-419.8641	-310.9307	-186.0758	-84.1625	-50.3727	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													8217.0780 (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													3193.7287 (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)													312.1569 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4965.4872 (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													6843.4763 (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	8217.0780	0.2100	1725.5864 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3193.7287	0.2100	670.6830 (264)
Space and water heating			2396.2694 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	312.1569	0.1443	45.0539 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1593.0594	0.1356	-215.9394
PV Unit electricity exported	-3372.4278	0.1263	-425.9755
Total			-641.9149 (269)
Total CO2, kg/year			1811.3376 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.1500 (273)

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

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	Energy kWh/year	Primary energy kg CO2/kWh	factor	Primary energy kWh/year
Space heating - main system 1	8217.0780	1.1300		9285.2982 (275)
Total CO2 associated with community systems				0.0000 (473)
Water heating (other fuel)	3193.7287	1.1300		3608.9134 (278)
Space and water heating				12894.2115 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128		130.1008 (281)
Energy for lighting	312.1569	1.5338		478.7966 (282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1593.0594	1.5010		-2391.2198
PV Unit electricity exported	-3372.4278	0.4637		-1563.6828
Total				-3954.9026 (283)
Total Primary energy kWh/year				9548.2063 (286)
Target Primary Energy Rate (TPER)				48.2400 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b)
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 575.6618 (5)

2. Ventilation rate

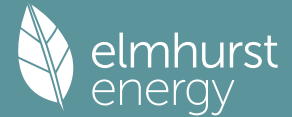
	Value	Reference
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0695 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.2195	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1866 (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	0.2379	0.2332	0.2285	0.2052	0.2006	0.1772	0.1772	0.1726	0.1866	0.2006	0.2099	0.2192 (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	0.5283	0.5272	0.5261	0.5211	0.5201	0.5157	0.5157	0.5149	0.5174	0.5201	0.5220	0.5240 (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
Window (Uw = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)
10-12			2.3400	1.2357	2.8916		(27a)
13-15			2.3400	1.2357	2.8916		(27a)
25-29			3.8900	1.2357	4.8070		(27a)
30-31			1.5600	1.2357	1.9278		(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.0000 (28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800 (29a)

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External Wall 2 Render	90.7700	11.2400	79.5300	0.1800	14.3154	9.0000	715.7700 (29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300 (30)
Total net area of external elements Aum(A, m2)			456.7800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	126.3213			(33)
Internal Wall 1 GF			118.5600			9.0000	1067.0400 (32c)
Internal Wall 2 FF			214.5800			9.0000	1931.2200 (32c)
Internal Floor 1			97.4600			18.0000	1754.2800 (32d)
Internal Ceiling 1			97.4600			9.0000	877.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)

Point Thermal bridges 0.0000 (36a) =

Total fabric heat loss (33) + (36) + (36a) = 151.5313 (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	100.3585	100.1498	99.9452	98.9844	98.8047	97.9678	97.9678	97.8129	98.2902	98.8047	99.1683	99.5485 (38)
Average = Sum(39)m / 12 =	251.8897	251.6810	251.4765	250.5157	250.3359	249.4991	249.4991	249.3441	249.8214	250.3359	250.6996	251.0798 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2727	1.2716	1.2706	1.2657	1.2648	1.2606	1.2606	1.2598	1.2622	1.2648	1.2667	1.2686 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

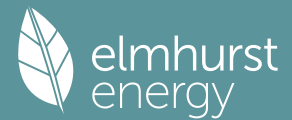
4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	32.1636	31.6859	31.0132	29.7730	28.8443	27.8145	27.2582	27.9262	28.6535	29.7554	31.0212	32.0548 (42b)
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449 (42c)
Average daily hot water use (litres/day)												71.0434 (43)
Daily hot water use	77.5085	75.3819	73.0604	70.1712	67.5936	64.9149	64.3587	66.6755	69.0517	71.8025	74.7172	77.3998 (44)
Energy content (annual)	122.7546	107.3429	112.2911	96.0609	90.9940	79.8204	77.8362	82.5582	85.1477	97.4353	106.4484	121.1894 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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												
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 (57)
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 (59)
Total heat required for water heating calculated for each month	104.3414	91.2414	95.4474	81.6517	77.3449	67.8474	66.1608	70.1745	72.3755	82.8200	90.4812	103.0110 (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	104.3414	91.2414	95.4474	81.6517	77.3449	67.8474	66.1608	70.1745	72.3755	82.8200	90.4812	103.0110 (64)
Total per year (kWh/year) = Sum(64)m =												1002.8971 (64)
Electric shower(s)	59.6675	53.1643	58.0533	55.3996	56.4391	53.8375	55.6320	56.4391	55.3996	58.0533	56.9617	59.6675 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												678.7147 (64a)
Heat gains from water heating, kWh/month	41.0022	36.1014	38.3752	34.2628	33.4460	30.4212	30.4482	31.6534	31.9438	35.2183	36.8607	40.6696 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(66)m	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	149.9607	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	186.1505	206.0952	186.1505	192.3555	186.1505	192.3555	186.1505	186.1505	192.3555	186.1505	192.3555	186.1505	186.1505	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.0642	372.8940	363.2432	342.6978	316.7629	292.3877	276.1036	272.2739	281.9247	302.4701	328.4050	352.7801	352.7801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	(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	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	(71)
Water heating gains (Table 5)	55.1105	53.7224	51.5796	47.5873	44.9543	42.2517	40.9250	42.5449	44.3664	47.3365	51.1954	54.6635	54.6635	(72)
Total internal gains	678.3135	700.6997	668.9614	650.6287	615.8559	594.9831	571.1673	568.9575	586.6348	603.9453	639.9442	661.5823	661.5823	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W								
East	1.4400	19.6403	0.7600	0.7000	0.7700	10.4269 (76)								
South	10.3500	46.7521	0.7600	0.7000	0.7700	178.3964 (78)								
West	25.9800	19.6403	0.7600	0.7000	0.7700	188.1184 (80)								
North	3.8900	26.0000	0.7600	0.7000	1.0000	48.4258 (82)								
East	1.5600	26.0000	0.7600	0.7000	1.0000	19.4201 (82)								
South	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)								
West	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)								
Solar gains	503.0480	942.4772	1477.4268	2081.0369	2512.8365	2562.2118	2443.0544	2118.8317	1690.4738	1096.1114	619.0812	419.2800	419.2800	(83)
Total gains	1181.3615	1643.1769	2146.3883	2731.6657	3128.6924	3157.1950	3014.2218	2687.7892	2277.1086	1700.0567	1259.0254	1080.8623	1080.8623	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	21.4348	21.4526	21.4700	21.5524	21.5679	21.6402	21.6402	21.6537	21.6123	21.5679	21.5366	21.5040
tau	2.4290	2.4302	2.4313	2.4368	2.4379	2.4427	2.4427	2.4436	2.4408	2.4379	2.4358	2.4336
util living area	0.9667	0.9306	0.8646	0.7449	0.5989	0.4535	0.3439	0.3945	0.6057	0.8403	0.9448	0.9727
MIT	17.9396	18.4795	19.2106	20.0027	20.5451	20.8345	20.9387	20.9131	20.6548	19.8236	18.7033	17.8331
Th 2	19.8623	19.8631	19.8639	19.8678	19.8685	19.8718	19.8718	19.8724	19.8705	19.8685	19.8670	19.8655
util rest of house	0.9614	0.9203	0.8453	0.7111	0.5491	0.3865	0.2626	0.3081	0.5371	0.8093	0.9349	0.9683
MIT 2	17.0819	17.6116	18.3186	19.0618	19.5411	19.7765	19.8470	19.8347	19.6514	18.9229	17.8420	16.9788
Living area fraction	17.3212	17.8537	18.5675	19.3243	19.8212	20.0717	20.1516	20.1356	19.9313	19.1742	18.0823	17.2172
MIT	17.3212	17.8537	18.5675	19.3243	19.8212	20.0717	20.1516	20.1356	19.9313	19.1742	18.0823	17.2172
Temperature adjustment												0.0000
adjusted MIT	17.3212	17.8537	18.5675	19.3243	19.8212	20.0717	20.1516	20.1356	19.9313	19.1742	18.0823	17.2172

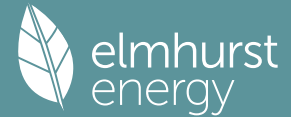
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9448	0.8963	0.8186	0.6929	0.5469	0.3989	0.2834	0.3291	0.5411	0.7863	0.9134	0.9537
Useful gains	1116.1187	1472.7451	1757.0654	1892.8114	1710.9526	1259.3160	854.2006	884.5422	1232.0605	1336.8332	1150.0115	1030.7743
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	3279.9043	3260.2112	3034.6874	2611.4612	2033.0361	1365.1803	886.1192	931.4439	1456.7931	2146.4322	2753.2598	3268.3493
Space heating kWh	1609.8564	1201.1773	950.5508	517.4278	239.6301	0.0000	0.0000	0.0000	0.0000	602.3416	1154.3387	1664.7558
Space heating requirement - total per year (kWh/year)												7940.0786
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1609.8564	1201.1773	950.5508	517.4278	239.6301	0.0000	0.0000	0.0000	0.0000	602.3416	1154.3387	1664.7558
Space heating requirement after solar contribution - total per year (kWh/year)												7940.0786
Space heating per m2										(98c) / (4) =		40.1176

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	2345.2916	1846.2934	1895.0154	0.0000	0.0000	0.0000	0.0000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8297	0.8759	0.8438	0.0000	0.0000	0.0000	0.0000
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1945.9349	1617.0801	1598.9247	0.0000	0.0000	0.0000	0.0000

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3441.9360	3287.3492	2935.7722	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1077.1208	1242.6802	994.6146	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction	fc = cooled area / (4) =											1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	269.2802	310.6700	248.6536	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												828.6039	(107)
Energy for space heating												40.1176	(99)
Energy for space cooling												4.1866	(108)
Total												44.3042	(109)
Fabric Energy Efficiency (DFEE)												44.3	(109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	575.6618 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0695 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3195 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716 (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	0.3462	0.3395	0.3327	0.2987	0.2919	0.2580	0.2580	0.2512	0.2716	0.2919	0.3055	0.3191 (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	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509 (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
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type (Uw = 1.20)			37.3500	1.1450	42.7672		(27)
10-12			2.3100	1.5918	3.6770		(27a)
13-15			2.3100	1.5918	3.6770		(27a)
25-29			3.8500	1.5918	6.1283		(27a)
30-31			1.5400	1.5918	2.4513		(27a)
Floor 1 P/a 0.46			100.4600	0.1300	13.0598		(28a)
External Wall 1 Stone	149.5500	28.3200	121.2300	0.1800	21.8214		(29a)
External Wall 2 Render	90.7700	11.1300	79.6400	0.1800	14.3352		(29a)
External Roof 1	116.0000	10.0100	105.9900	0.1100	11.6589		(30)

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Total net area of external elements Aum(A, m²) 456.7800 (31)
 Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 121.6760 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0900	2.5830
E5 Ground floor (normal)	46.5000	0.1600	7.4400
E6 Intermediate floor within a dwelling	42.5000	0.0000	0.0000
E13 Gable (insulation at rafter level)	19.8600	0.0800	1.5888
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0900	-0.7650
R4 Ridge (vaulted ceiling)	18.9600	0.0800	1.5168
R7 Flat ceiling (inverted)	3.2000	0.0400	0.1280
E11 Eaves (insulation at rafter level)	32.0700	0.0400	1.2828
E2 Other lintels (including other steel lintels)	22.9500	0.0500	1.1475
E3 Sill	21.9500	0.0500	1.0975
E4 Jamb	54.8000	0.0500	2.7400
R1 Head of roof window	8.5800	0.0800	0.6864
R2 Sill of roof window	8.5800	0.0600	0.5148
R3 Jamb of roof window	30.6800	0.0800	2.4544

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.4150 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 144.0910 (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	106.3712	105.9291	105.4957	103.4599	103.0790	101.3060	101.3060	100.9776	101.9889	103.0790	103.8495	104.6551
Average = Sum(39)m / 12 =	250.4622	250.0201	249.5867	247.5509	247.1700	245.3970	245.3970	245.0686	246.0799	247.1700	247.9405	248.7461

HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2655	1.2632	1.2610	1.2508	1.2488	1.2399	1.2399	1.2382	1.2433	1.2488	1.2527	1.2568
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9992 (42)

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

Hot water usage for baths 32.1636 31.6859 31.0132 29.7730 28.8443 27.8145 27.2582 27.9262 28.6535 29.7554 31.0212 32.0548 (42b)

Hot water usage for other uses 45.3449 43.6960 42.0471 40.3982 38.7493 37.1004 37.1004 38.7493 40.3982 42.0471 43.6960 45.3449 (42c)

Average daily hot water use (litres/day) 71.0434 (43)

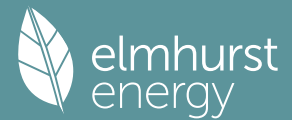
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	77.5085	75.3819	73.0604	70.1712	67.5936	64.9149	64.3587	66.6755	69.0517	71.8025	74.7172	77.3998
Energy conte	122.7546	107.3429	112.2911	96.0609	90.9940	79.8204	77.8362	82.5582	85.1477	97.4353	106.4484	121.1894
Energy content (annual)	Total = Sum(45)m = 1179.8790											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water storage loss:	Total storage loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (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	104.3414	91.2414	95.4474	81.6517	77.3449	67.8474	66.1608	70.1745	72.3755	82.8200	90.4812	103.0110
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	104.3414	91.2414	95.4474	81.6517	77.3449	67.8474	66.1608	70.1745	72.3755	82.8200	90.4812	103.0110
Total per year (kWh/year) = Sum(64)m = 1002.8971 (64)												
12Total per year (kWh/year) = 1003 (64)												
Electric shower(s)	59.6675	53.1643	58.0533	55.3996	56.4391	53.8375	55.6320	56.4391	55.3996	58.0533	56.9617	59.6675
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 678.7147 (64a)												
Heat gains from water heating, kWh/month	41.0022	36.1014	38.3752	34.2628	33.4460	30.4212	30.4482	31.6534	31.9438	35.2183	36.8607	40.6696

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	186.1505	206.0952	186.1505	192.3555	186.1505	192.3555	186.1505	186.1505	192.3555	186.1505	192.3555	186.1505
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.0642	372.8940	363.2432	342.6978	316.7629	292.3877	276.1036	272.2739	281.9247	302.4701	328.4050	352.7801
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961	37.9961

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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	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	(71)
Water heating gains (Table 5)	55.1105	53.7224	51.5796	47.5873	44.9543	42.2517	40.9250	42.5449	44.3664	47.3365	51.1954	54.6635					(72)
Total internal gains	678.3135	700.6997	668.9614	650.6287	615.8559	594.9831	571.1673	568.9575	586.6348	603.9453	639.9442	661.5823					(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233 (76)
South	10.2400	46.7521	0.6300	0.7000	0.7700	146.3095 (78)
West	25.6900	19.6403	0.6300	0.7000	0.7700	154.1996 (80)
North	3.8500	26.0000	0.6300	0.7000	1.0000	39.7297 (82)
East	1.5400	26.0000	0.6300	0.7000	1.0000	15.8919 (82)
South	2.3100	26.0000	0.6300	0.7000	1.0000	23.8378 (82)
West	2.3100	26.0000	0.6300	0.7000	1.0000	23.8378 (82)

Solar gains	412.3296	772.4781	1210.8635	1705.4775	2059.2886	2099.7287	2002.0887	1736.4265	1385.4396	898.3798	507.4310	343.6726	(83)
Total gains	1090.6431	1473.1779	1879.8249	2356.1062	2675.1445	2694.7119	2573.2560	2305.3840	1972.0744	1502.3251	1147.3751	1005.2550	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
tau	21.5570	21.5951	21.6326	21.8105	21.8441	22.0019	22.0019	22.0314	21.9409	21.8441	21.7762	21.7057
alpha	2.4371	2.4397	2.4422	2.4540	2.4563	2.4668	2.4668	2.4688	2.4627	2.4563	2.4517	2.4470
util living area	0.9718	0.9436	0.8916	0.7899	0.6551	0.5070	0.3895	0.4424	0.6563	0.8683	0.9540	0.9766
MIT	17.8738	18.3600	19.0520	19.8589	20.4500	20.7936	20.9219	20.8914	20.5929	19.7255	18.6355	17.7900
Th 2	19.8680	19.8697	19.8715	19.8796	19.8811	19.8882	19.8882	19.8895	19.8855	19.8811	19.8780	19.8748
util rest of house	0.9673	0.9350	0.8752	0.7593	0.6062	0.4369	0.3010	0.3501	0.5889	0.8412	0.9455	0.9728
MIT 2	17.0207	17.5001	18.1750	18.9449	19.4780	19.7665	19.8556	19.8410	19.6209	18.8440	17.7835	16.9420
Living area fraction									fLA = Living area / (4) =			0.2790
MIT	17.2587	17.7401	18.4197	19.1999	19.7492	20.0531	20.1531	20.1341	19.8921	19.0899	18.0212	17.1786
Temperature adjustment												0.0000
adjusted MIT	17.2587	17.7401	18.4197	19.1999	19.7492	20.0531	20.1531	20.1341	19.8921	19.0899	18.0212	17.1786

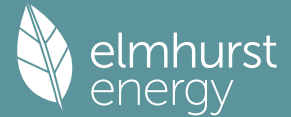
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9523	0.9131	0.8489	0.7380	0.5999	0.4478	0.3229	0.3714	0.5893	0.8175	0.9260	0.9596
Useful gains	1038.6550	1345.2110	1595.7943	1738.7382	1604.9300	1206.7439	831.0268	856.3319	1162.2127	1228.1365	1062.4451	964.6883
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	3245.6753	3210.2705	2974.9952	2549.7546	1989.5191	1338.1711	871.9243	915.1028	1425.3130	2098.4545	2707.8084	3228.3801
Space heating kWh	1642.0231	1253.3200	1026.1255	583.9318	286.1342	0.0000	0.0000	0.0000	0.0000	647.5166	1184.6616	1684.1867
Space heating requirement - total per year (kWh/year)												8307.8995
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	1642.0231	1253.3200	1026.1255	583.9318	286.1342	0.0000	0.0000	0.0000	0.0000	647.5166	1184.6616	1684.1867
Space heating requirement after solar contribution - total per year (kWh/year)												8307.8995
Space heating per m ²										(98c) / (4) =		41.9760

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	2306.7314	1815.9375	1862.5214	0.0000	0.0000	0.0000	0.0000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7909	0.8446	0.8087	0.0000	0.0000	0.0000	0.0000
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1824.3332	1533.7166	1506.1949	0.0000	0.0000	0.0000	0.0000
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2930.9936	2799.9277	2512.0586	0.0000	0.0000	0.0000	0.0000
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	796.7955	942.0611	748.3626	0.0000	0.0000	0.0000	0.0000
Cooled fraction									fC = cooled area / (4) =			1.0000
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
Space cooling kWh												

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	0.0000	0.0000	0.0000	0.0000	0.0000	199.1989	235.5153	187.0906	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												621.8048 (107)
Energy for space heating												41.9760 (99)
Energy for space cooling												3.1417 (108)
Total												45.1177 (109)
Fabric Energy Efficiency (TFEE)												45.1 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	575.6618 (5)

2. Ventilation rate

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

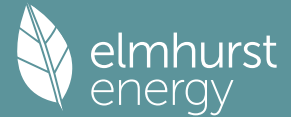
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	3.0000	(17)
Infiltration rate	0.1500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (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
Window (Uw = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)
10-12			2.3400	1.2357	2.8916		(27a)
13-15			2.3400	1.2357	2.8916		(27a)
25-29			3.8900	1.2357	4.8070		(27a)
30-31			1.5600	1.2357	1.9278		(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.6000 (28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800 (29a)
External Wall 2 Render	90.7700	11.2400	79.5300	0.1800	14.3154	9.0000	715.7700 (29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300 (30)
Total net area of external elements Aum(A, m ²)			456.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	126.3213		(33)
Internal Wall 1 GF			118.5600			9.0000	1067.0400 (32c)
Internal Wall 2 FF			214.5800			9.0000	1931.2200 (32c)

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Internal Floor 1	97.4600	18.0000	1754.2800 (32d)
Internal Ceiling 1	97.4600	9.0000	877.1400 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 151.5313 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.9287	48.3232	47.7177	44.6901	44.0845	41.0569	41.0569	40.4514	42.2680	44.0845	45.2956	46.5066 (38)
Average = Sum(39)m / 12 =	200.4600	199.8545	199.2489	196.2213	195.6158	192.5882	192.5882	191.9827	193.7992	195.6158	196.8269	198.0379 (39)
												196.0699

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0128	1.0098	1.0067	0.9914	0.9884	0.9731	0.9731	0.9700	0.9792	0.9884	0.9945	1.0006 (40)
HLP (average)												0.9907
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9992 (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	85.9543	84.6778	82.8801	79.5656	77.0837	74.3317	72.8452	74.6303	76.5739	79.5186	82.9014	85.6637 (42b)	
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449 (42c)	
Average daily hot water use (litres/day)													120.9158 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087 (44)	
Energy conte	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279 (45)	
Energy content (annual)													Total = Sum(45)m = 2007.9821
Distribution loss (46)m = 0.15 x (45)m	31.1919	27.4204	28.8013	24.6337	23.3900	20.5528	19.9455	21.0581	21.6357	24.7445	27.0542	30.7692 (46)	

Water storage loss:
 Store volume 300.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 2.2000 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 1.1880 (55)

Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage												
Primary loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

WWHRS	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183 (62)	
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)	
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)	
	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183 (64)	
													Total per year (kWh/year) = Sum(64)m = 2715.4981 (64)

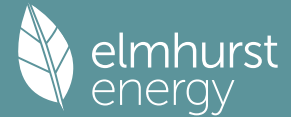
Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month	117.2143	104.2020	111.9152	101.1262	99.9202	92.0803	92.2847	94.7512	94.4808	102.9227	106.4917	116.2773 (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	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.2848	43.7743	35.5996	26.9512	20.1464	17.0084	18.3782	23.8887	32.0633	40.7117	47.5166	50.6545 (67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	550.8421	556.5582	542.1540	511.4892	472.7804	436.3996	412.0950	406.3789	420.7831	451.4479	490.1567	526.5375	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	(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)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	(71)
Water heating gains (Table 5)	157.5461	155.0625	150.4236	140.4531	134.3014	127.8894	124.0386	127.3538	131.2234	138.3370	147.9052	156.2868	(72)
Total internal gains	873.6518	871.3737	844.1560	794.8723	743.2069	697.2761	670.4905	673.6001	700.0486	746.4754	801.5572	849.4576	(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							
East	1.4400	19.6403	0.7600	0.7000	0.7700	10.4269 (76)							
South	10.3500	46.7521	0.7600	0.7000	0.7700	178.3964 (78)							
West	25.9800	19.6403	0.7600	0.7000	0.7700	188.1184 (80)							
North	3.8900	26.0000	0.7600	0.7000	1.0000	48.4258 (82)							
East	1.5600	26.0000	0.7600	0.7000	1.0000	19.4201 (82)							
South	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)							
West	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)							
Solar gains	503.0480	942.4772	1477.4268	2081.0369	2512.8365	2562.2118	2443.0544	2118.8317	1690.4738	1096.1114	619.0812	419.2800	(83)
Total gains	1376.6998	1813.8509	2321.5828	2875.9092	3256.0434	3259.4879	3113.5449	2792.4318	2390.5223	1842.5868	1420.6385	1268.7376	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)	26.9341	27.0157	27.0978	27.5159	27.6011	28.0350	28.0350	28.1234	27.8598	27.6011	27.4313	27.2635	21.0000 (85)
tau	2.7956	2.8010	2.8065	2.8344	2.8401	2.8690	2.8690	2.8749	2.8573	2.8401	2.8288	2.8176	
util living area	0.9492	0.9012	0.8118	0.6649	0.5059	0.3634	0.2674	0.3083	0.5069	0.7750	0.9180	0.9580	(86)
Living	19.2155	19.5901	20.0647	20.5095	20.7495	20.8529	20.8807	20.8747	20.7885	20.3899	19.7088	19.1506	
Non living	17.9686	18.4376	19.0200	19.5537	19.8212	19.9377	19.9616	19.9603	19.8764	19.4350	18.6028	17.8942	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.0871	19.5901	20.0647	20.5095	20.7495	20.8529	20.8807	20.8747	20.7885	20.3899	19.7088	19.4093	(87)
Th 2	20.0727	20.0752	20.0777	20.0905	20.0930	20.1058	20.1058	20.1084	20.1007	20.0930	20.0879	20.0828	(88)
util rest of house	0.9423	0.8890	0.7908	0.6332	0.4657	0.3164	0.2147	0.2512	0.4525	0.7425	0.9057	0.9523	(89)
MIT 2	19.2339	18.4376	19.0200	19.5537	19.8212	19.9377	19.9616	19.9603	19.8764	19.4350	18.6028	18.2886	(90)
Living area fraction	19.4719	18.7591	19.3115	19.8204	20.0802	20.1931	20.2180	20.2154	20.1308	19.7014	18.9114	18.6012	(91)
MIT	19.4719	18.7591	19.3115	19.8204	20.0802	20.1931	20.2180	20.2154	20.1308	19.7014	18.9114	18.6012	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4719	18.7591	19.3115	19.8204	20.0802	20.1931	20.2180	20.2154	20.1308	19.7014	18.9114	18.6012	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9372	0.8682	0.7712	0.6231	0.4651	0.3211	0.2214	0.2582	0.4544	0.7268	0.8862	0.9406	(94)
Useful gains	1290.2517	1574.7552	1790.4161	1792.1012	1514.4157	1046.6509	689.3905	720.8937	1086.2320	1339.1132	1258.9325	1193.4369	(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	3041.3632	2769.8080	2552.6726	2142.8155	1639.2934	1077.1629	696.7885	732.4889	1168.7712	1780.3759	2324.7983	2851.9931	(97)
Space heating kWh	1302.8270	803.0755	567.1188	252.5144	92.9090	0.0000	0.0000	0.0000	0.0000	328.2995	767.4234	1233.9658	(98a)
Space heating requirement - total per year (kWh/year)												5348.1332	
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	1302.8270	803.0755	567.1188	252.5144	92.9090	0.0000	0.0000	0.0000	0.0000	328.2995	767.4234	1233.9658	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5348.1332	
Space heating per m2										(98c) / (4) =		27.0217	(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 %)	274.1474	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1302.8270	803.0755	567.1188	252.5144	92.9090	0.0000	0.0000	0.0000	0.0000	328.2995	767.4234	1233.9658	(98)	
Space heating efficiency (main heating system 1)	274.1474	274.1474	274.1474	274.1474	274.1474	0.0000	0.0000	0.0000	0.0000	274.1474	274.1474	274.1474	(210)	
Space heating fuel (main heating system)	475.2287	292.9357	206.8664	92.1090	33.8902	0.0000	0.0000	0.0000	0.0000	119.7529	279.9310	450.1104	(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	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183	(64)	
Efficiency of water heater	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	(216)	
Fuel for water heating, kWh/month	142.0227	125.6189	133.5781	117.8292	114.4632	103.4139	102.2955	106.2260	107.2393	119.2479	126.3795	140.5295	(219)	
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)	
Pumps and Fa	49.8657	45.0400	49.8657	48.2572	49.8657	48.2572	49.8657	49.8657	48.2572	49.8657	48.2572	49.8657	(231)	
Lighting	43.1387	34.6074	31.1602	22.8293	17.6340	14.4071	16.0863	20.9096	27.1595	35.6347	40.2493	44.3376	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-97.1587	-137.3998	-195.6000	-211.5537	-219.8739	-198.8724	-196.6605	-186.6009	-166.8099	-150.4446	-105.4261	-83.2771	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	-40.5792	-92.4451	-195.8522	-313.0694	-428.2538	-438.3404	-432.1312	-362.7775	-263.4636	-143.3816	-57.9509	-31.9860	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													1950.8243	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													188.7278	
Water heating fuel used													1438.8437	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)														
mechanical ventilation fans (SFP = 0.8360)													587.1290	(230a)
Total electricity for the above, kWh/year													587.1290	(231)
Electricity for lighting (calculated in Appendix L)													348.1537	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-4749.9083	(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													-424.9576	(238)

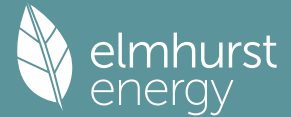
10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1950.8243	16.4900	321.6909 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1438.8437	16.4900	237.2653 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	587.1290	16.4900	96.8176 (249)
Energy for lighting	348.1537	16.4900	57.4106 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1949.6775	16.4900	-321.5018
PV Unit electricity exported	-2800.2308	5.5900	-156.5329
Total			-478.0347 (252)
Total energy cost			235.1497 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3485 (257)

Full SAP Calculation Printout



SAP value 94.3511
 SAP rating (Section 12) 94 (258)
 SAP band A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1950.8243	0.1566	305.5516 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1438.8437	0.1408	202.5972 (264)
Space and water heating			508.1488 (265)
Pumps, fans and electric keep-hot	587.1290	0.1387	81.4420 (267)
Energy for lighting	348.1537	0.1443	50.2493 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1949.6775	0.1354	-263.9212
PV Unit electricity exported	-2800.2308	0.1242	-347.7576
Total			-611.6789 (269)
Total CO2, kg/year			28.1613 (272)
CO2 emissions per m2			0.1400 (273)
EI value			99.8447
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 575.6618 (5)

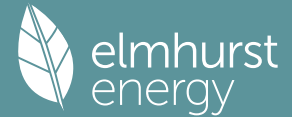
2. Ventilation rate

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

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.2000	6.0000	6.0000	5.4000	5.2000	4.6000	4.5000	4.4000	4.8000	5.6000	5.7000	6.0000 (22)
Wind factor	1.5500	1.5000	1.5000	1.3500	1.3000	1.1500	1.1250	1.1000	1.2000	1.4000	1.4250	1.5000 (22a)
Adj infilt rate	0.1976	0.1913	0.1913	0.1721	0.1658	0.1466	0.1434	0.1403	0.1530	0.1785	0.1817	0.1913 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2926	0.2863	0.2863	0.2671	0.2607	0.2416	0.2384	0.2352	0.2480	0.2735	0.2767	0.2863 (25)

Full SAP Calculation Printout



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
Window (Uw = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)
10-12			2.3400	1.2357	2.8916		(27a)
13-15			2.3400	1.2357	2.8916		(27a)
25-29			3.8900	1.2357	4.8070		(27a)
30-31			1.5600	1.2357	1.9278		(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.6000 (28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800 (29a)
External Wall 2 Render	90.7700		79.5300	0.1800	14.3154	9.0000	715.7700 (29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300 (30)
Total net area of external elements Aum(A, m2)			456.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					126.3213		(33)
Internal Wall 1 GF			118.5600			9.0000	1067.0400 (32c)
Internal Wall 2 FF			214.5800			9.0000	1931.2200 (32c)
Internal Floor 1			97.4600			18.0000	1754.2800 (32d)
Internal Ceiling 1			97.4600			9.0000	877.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 151.5313 (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	55.5895	54.3785	54.3785	50.7453	49.5343	45.9011	45.2956	44.6901	47.1122	51.9564	52.5619	54.3785 (38)
Average = Sum(39)m / 12 =	207.1208	205.9097	205.9097	202.2766	201.0655	197.4324	196.8269	196.2213	198.6434	203.4876	204.0931	205.9097 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0465	1.0404	1.0404	1.0220	1.0159	0.9975	0.9945	0.9914	1.0037	1.0281	1.0312	1.0404 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9992 (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	85.9543	84.6778	82.8801	79.5656	77.0837	74.3317	72.8452	74.6303	76.5739	79.5186	82.9014	85.6637	(42b)
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449	(42c)
Average daily hot water use (litres/day)													120.9158 (43)
Daily hot water use	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087	(44)
Energy conte	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279	(45)
Energy content (annual)													Total = Sum(45)m = 2007.9821
Distribution loss (46)m = 0.15 x (45)m	31.1919	27.4204	28.8013	24.6337	23.3900	20.5528	19.9455	21.0581	21.6357	24.7445	27.0542	30.7692	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280	(56)
If cylinder contains dedicated solar storage													
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	(57)
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	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183	(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)

Full SAP Calculation Printout



Space heating kWh	1023.8988	644.3867	474.5889	229.5173	101.9947	0.0000	0.0000	0.0000	0.0000	231.1151	542.3489	937.9228 (98a)
Space heating requirement - total per year (kWh/year)												4185.7731
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	1023.8988	644.3867	474.5889	229.5173	101.9947	0.0000	0.0000	0.0000	0.0000	231.1151	542.3489	937.9228 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4185.7731
Space heating per m2												(98c) / (4) = 21.1488 (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 %)												276.2024 (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	1023.8988	644.3867	474.5889	229.5173	101.9947	0.0000	0.0000	0.0000	0.0000	231.1151	542.3489	937.9228 (98)
Space heating efficiency (main heating system 1)	276.2024	276.2024	276.2024	276.2024	276.2024	0.0000	0.0000	0.0000	0.0000	276.2024	276.2024	276.2024 (210)
Space heating fuel (main heating system)	370.7059	233.3023	171.8265	83.0975	36.9275	0.0000	0.0000	0.0000	0.0000	83.6760	196.3592	339.5780 (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	268.0363	237.0778	252.0989	222.3765	216.0239	195.1708	193.0601	200.4780	202.3903	225.0540	238.5133	265.2183 (64)
Efficiency of water heater (217)m	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412 (216)
Fuel for water heating, kWh/month	142.0126	125.6099	133.5685	117.8208	114.4551	103.4065	102.2882	106.2185	107.2316	119.2394	126.3705	140.5195 (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	49.8657	45.0400	49.8657	48.2572	49.8657	48.2572	49.8657	49.8657	48.2572	49.8657	48.2572	49.8657 (231)
Lighting	43.1387	34.6074	31.1602	22.8293	17.6340	14.4071	16.0863	20.9096	27.1595	35.6347	40.2493	44.3376 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-118.9666	-147.4302	-207.1980	-225.7169	-227.8449	-211.4872	-202.4359	-198.5607	-181.4214	-163.5168	-123.1689	-99.1688 (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	-62.4639	-112.7258	-232.4777	-376.4868	-470.5862	-537.8029	-474.2046	-436.8231	-328.5535	-181.7936	-84.2591	-46.9192 (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												1515.4729 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												188.7412
Water heating fuel used												1438.7413 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)												
mechanical ventilation fans (SFP = 0.8360)												587.1290 (230a)
Total electricity for the above, kWh/year												587.1290 (231)
Electricity for lighting (calculated in Appendix L)												348.1537 (232)

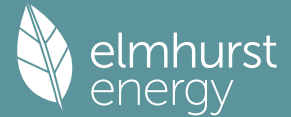
Energy saving/generation technologies (Appendices M ,N and Q)

PV generation												-5452.0127 (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												-1562.5157 (238)

 10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1515.4729	21.5100	325.9782 (240)

Full SAP Calculation Printout



Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1438.7413	21.5100	309.4733 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	587.1290	21.5100	126.2914 (249)
Energy for lighting	348.1537	21.5100	74.8879 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2106.9164	21.5100	-453.1977
PV Unit electricity exported	-3345.0962	5.5900	-186.9909
Total			-640.1886 (252)
Total energy cost			196.4422 (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	1515.4729	0.1565	237.1817 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1438.7413	0.1408	202.5828 (264)
Space and water heating			439.7644 (265)
Pumps, fans and electric keep-hot	587.1290	0.1387	81.4420 (267)
Energy for lighting	348.1537	0.1443	50.2493 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2106.9164	0.1359	-286.2571
PV Unit electricity exported	-3345.0962	0.1251	-418.6223
Total			-704.8794 (269)
Total CO2, kg/year			-133.4236 (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	1515.4729	1.5793	2393.4552 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1438.7413	1.5206	2187.8121 (278)
Space and water heating			4581.2673 (279)
Pumps, fans and electric keep-hot	587.1290	1.5128	888.2087 (281)
Energy for lighting	348.1537	1.5338	534.0098 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2106.9164	1.5022	-3165.0064
PV Unit electricity exported	-3345.0962	0.4593	-1536.5589
Total			-4701.5653 (283)
Total Primary energy kWh/year			1301.9206 (286)

SAP 10 EPC IMPROVEMENTS

SEC1 ASHP actis

Current energy efficiency rating:	A 94
Current environmental impact rating:	A 100

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	SAP change Cost change CO2 change
N Solar water heating	+ 1.0 -£ 64 -44 kg (33.0%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£64	0.22 kg/m ²	A 95	A 100
Total Savings	£64	0.22 kg/m²		

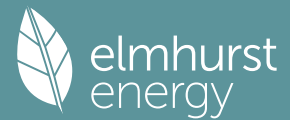
Potential energy efficiency rating:	A 95
Potential environmental impact rating:	A 100

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£837	£760	£76
Space heating	£452	£470	-£17
Water heating	£309	£216	£94
Lighting	£75	£75	£0

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Generated (PV)	-£640	-£628	-£13
Total cost of fuels	£197	£132	£63
Total cost of uses	£196	£133	£64
Delivered energy	-8 kWh/m ²	-10 kWh/m ²	2 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-1 kg/m ²	0 kg/m ²
Primary energy	7 kWh/m ²	4 kWh/m ²	2 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)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	575.6618 (5)

2. Ventilation rate

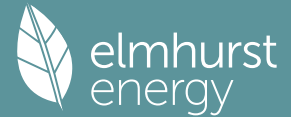
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1275 (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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2576	0.2544	0.2512	0.2352	0.2321	0.2161	0.2161	0.2129	0.2225	0.2321	0.2384	0.2448 (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
Window (Uw = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)
10-12			2.3400	1.2357	2.8916		(27a)
13-15			2.3400	1.2357	2.8916		(27a)
25-29			3.8900	1.2357	4.8070		(27a)
30-31			1.5600	1.2357	1.9278		(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.6000 (28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800 (29a)
External Wall 2 Render	90.7700	11.2400	79.5300	0.1800	14.3154	9.0000	715.7700 (29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300 (30)
Total net area of external elements Aum(A, m ²)			456.7800				(31)

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Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	126.3213		(33)
Internal Wall 1 GF	118.5600		9.0000	1067.0400 (32c)
Internal Wall 2 FF	214.5800		9.0000	1931.2200 (32c)
Internal Floor 1	97.4600		18.0000	1754.2800 (32d)
Internal Ceiling 1	97.4600		9.0000	877.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 151.5313 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	48.9287	48.3232	47.7177	44.6901	44.0845	41.0569	41.0569	40.4514	42.2680	44.0845	45.2956	46.5066 (38)
Average = Sum(39)m / 12 =	200.4600	199.8545	199.2489	196.2213	195.6158	192.5882	192.5882	191.9827	193.7992	195.6158	196.8269	198.0379 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0128	1.0098	1.0067	0.9914	0.9884	0.9731	0.9731	0.9700	0.9792	0.9884	0.9945	1.0006 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9992 (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 85.9543 84.6778 82.8801 79.5656 77.0837 74.3317 72.8452 74.6303 76.5739 79.5186 82.9014 85.6637 (42b)

Hot water usage for other uses 45.3449 43.6960 42.0471 40.3982 38.7493 37.1004 37.1004 38.7493 40.3982 42.0471 43.6960 45.3449 (42c)

Average daily hot water use (litres/day) 120.9158 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087 (44)
Energy content (annual)	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279 (45)

Distribution loss (46)m = 0.15 x (45)m
 31.1919 27.4204 28.8013 24.6337 23.3900 20.5528 19.9455 21.0581 21.6357 24.7445 27.0542 30.7692 (46)

Water storage loss:
 Store volume 300.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day):
 Temperature factor from Table 2b 2.2000 (48)
 Enter (49) or (54) in (55) 0.5400 (49)
 Total storage loss 1.1880 (55)

36.8280 33.2640 36.8280 35.6400 36.8280 35.6400 36.8280 36.8280 35.6400 36.8280 35.6400 36.8280 36.8280 (56)
If cylinder contains dedicated solar storage
36.8280 33.2640 36.8280 35.6400 36.8280 35.6400 36.8280 36.8280 35.6400 36.8280 35.6400 36.8280 36.8280 (57)
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

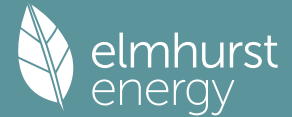
Total heat required for water heating calculated for each month
 268.0363 237.0778 250.7032 215.6229 203.2296 182.5641 180.0332 188.3816 196.9874 223.6582 238.5133 265.2183 (62)

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 622.2715 (H24)
 Heat delivered to space heating 0.0000 (H29)
 Solar input 622.2715

Solar input -0.0000 -16.2111 -58.2803 -80.1302 -104.6739 -96.5905 -96.0005 -83.8804 -57.8306 -28.6739 -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)

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Output from w/h	268.0363	220.8666	192.4229	135.4926	98.5557	85.9736	84.0327	104.5012	139.1568	194.9843	238.5133	265.2183 (64)
	Total per year (kWh/year) = Sum(64)m =											2027.7542 (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	117.2143	104.2020	110.7986	95.7234	89.6848	81.9950	81.8632	85.0740	90.1585	101.8061	106.4917	116.2773 (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	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.2848	43.7743	35.5996	26.9512	20.1464	17.0084	18.3782	23.8887	32.0633	40.7117	47.5166	50.6545 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	550.8421	556.5582	542.1540	511.4892	472.7804	436.3996	412.0950	406.3789	420.7831	451.4479	490.1567	526.5375 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945 (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)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685 (71)
Water heating gains (Table 5)	157.5461	155.0625	148.9228	132.9491	120.5440	113.8819	110.0312	114.3468	125.2202	136.8362	147.9052	156.2868 (72)
Total internal gains	873.6518	871.3737	842.6552	787.3683	729.4495	683.2686	656.4831	660.5932	694.0454	744.9746	801.5572	849.4576 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East	1.4400	19.6403	0.7600	0.7000	0.7700	10.4269 (76)						
South	10.3500	46.7521	0.7600	0.7000	0.7700	178.3964 (78)						
West	25.9800	19.6403	0.7600	0.7000	0.7700	188.1184 (80)						
North	3.8900	26.0000	0.7600	0.7000	1.0000	48.4258 (82)						
East	1.5600	26.0000	0.7600	0.7000	1.0000	19.4201 (82)						
South	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)						
West	2.3400	26.0000	0.7600	0.7000	1.0000	29.1302 (82)						
Solar gains	503.0480	942.4772	1477.4268	2081.0369	2512.8365	2562.2118	2443.0544	2118.8317	1690.4738	1096.1114	619.0812	419.2800 (83)
Total gains	1376.6998	1813.8509	2320.0820	2868.4052	3242.2861	3245.4805	3099.5375	2779.4249	2384.5191	1841.0860	1420.6385	1268.7376 (84)

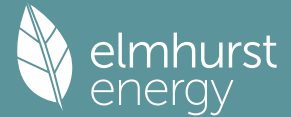
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	tau	26.9341	27.0157	27.0978	27.5159	27.6011	28.0350	28.0350	28.1234	27.8598	27.6011	27.4313	27.2635
	alpha	2.7956	2.8010	2.8065	2.8344	2.8401	2.8690	2.8690	2.8749	2.8573	2.8401	2.8288	2.8176
util living area		0.9492	0.9012	0.8120	0.6659	0.5076	0.3648	0.2685	0.3096	0.5079	0.7753	0.9180	0.9580 (86)
Living	19.2155	19.5901	20.0641	20.5079	20.7483	20.8525	20.8806	20.8745	20.7879	20.3894	19.7088	19.1506	
Non living	17.9686	18.4376	19.0193	19.5519	19.8200	19.9374	19.9615	19.9601	19.8759	19.4344	18.6028	17.8942	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.0871	19.5901	20.0641	20.5079	20.7483	20.8525	20.8806	20.8745	20.7879	20.3894	19.7088	19.4093 (87)	
Th 2	20.0727	20.0752	20.0777	20.0905	20.0930	20.1058	20.1058	20.1084	20.1007	20.0930	20.0879	20.0828 (88)	
util rest of house		0.9423	0.8890	0.7910	0.6342	0.4673	0.3177	0.2157	0.2523	0.4534	0.7428	0.9057	0.9523 (89)
MIT 2	19.2339	18.4376	19.0193	19.5519	19.8200	19.9374	19.9615	19.9601	19.8759	19.4344	18.6028	18.2886 (90)	
Living area fraction										FLA = Living area / (4) =		0.2790 (91)	
MIT	19.4719	18.7591	19.3108	19.8187	20.0790	20.1927	20.2179	20.2152	20.1303	19.7008	18.9114	18.6012 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.4719	18.7591	19.3108	19.8187	20.0790	20.1927	20.2179	20.2152	20.1303	19.7008	18.9114	18.6012 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9372	0.8682	0.7714	0.6241	0.4667	0.3224	0.2224	0.2593	0.4553	0.7270	0.8862	0.9406 (94)
Useful gains	1290.2517	1574.7552	1789.7330	1790.3109	1513.1092	1046.2695	689.2851	720.7270	1085.7087	1338.5441	1258.9325	1193.4369 (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	3041.3632	2769.8080	2552.5331	2142.4728	1639.0567	1077.0957	696.7694	732.4588	1168.6761	1780.2625	2324.7983	2851.9931 (97)
Space heating kWh	1302.8270	803.0755	567.5232	253.5566	93.7049	0.0000	0.0000	0.0000	0.0000	328.6385	767.4234	1233.9658 (98a)

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Space heating requirement - total per year (kWh/year)													5350.7148
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	1302.8270	803.0755	567.5232	253.5566	93.7049	0.0000	0.0000	0.0000	0.0000	328.6385	767.4234	1233.9658	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													5350.7148
Space heating per m2													(98c) / (4) = 27.0347 (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 %)													274.1474 (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	1302.8270	803.0755	567.5232	253.5566	93.7049	0.0000	0.0000	0.0000	0.0000	328.6385	767.4234	1233.9658	(98)
Space heating efficiency (main heating system 1)	274.1474	274.1474	274.1474	274.1474	274.1474	0.0000	0.0000	0.0000	0.0000	274.1474	274.1474	274.1474	(210)
Space heating fuel (main heating system)	475.2287	292.9357	207.0139	92.4891	34.1805	0.0000	0.0000	0.0000	0.0000	119.8766	279.9310	450.1104	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	268.0363	220.8666	192.4229	135.4926	98.5557	85.9736	84.0327	104.5012	139.1568	194.9843	238.5133	265.2183	(64)
Efficiency of water heater (217)m	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	188.7278	(216)
Fuel for water heating, kWh/month	142.0227	117.0292	101.9579	71.7926	52.2211	45.5543	44.5259	55.3714	73.7341	103.3151	126.3795	140.5295	(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	56.6603	51.1770	56.6603	54.8325	56.6603	54.8325	56.6603	56.6603	54.8325	56.6603	54.8325	56.6603	(231)
Lighting	43.1387	34.6074	31.1602	22.8293	17.6340	14.4071	16.0863	20.9096	27.1595	35.6347	40.2493	44.3376	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-97.2617	-137.3000	-193.5367	-205.6231	-207.9069	-186.0926	-183.9961	-177.0887	-162.3706	-149.7562	-105.6044	-83.3625	(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	-40.4762	-92.5449	-197.9155	-319.0000	-440.2208	-451.1201	-444.7956	-372.2897	-267.9029	-144.0699	-57.7726	-31.9006	(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													1951.7659 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													188.7278
Water heating fuel used													1074.4333 (219)
Space cooling fuel													0.0000 (221)

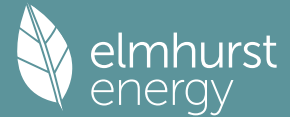
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)													
mechanical ventilation fans (SFP = 0.8360)													587.1290 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													667.1290 (231)
Electricity for lighting (calculated in Appendix L)													348.1537 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-4749.9083 (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													-708.4264 (238)

10a. Fuel costs - using Table 12 prices

	Fuel price kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1951.7659	16.4900	321.8462 (240)
Total CO2 associated with community systems			0.0000 (473)

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Water heating (other fuel)	1074.4333	16.4900	177.1740 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	587.1290	16.4900	96.8176 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	348.1537	16.4900	57.4106 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1889.8996	16.4900	-311.6444
PV Unit electricity exported	-2860.0088	5.5900	-159.8745
Total			-471.5189 (252)
Total energy cost			194.9214 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.2889 (257)
SAP value		95.3175
SAP rating (Section 12)		95 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1951.7659	0.1566	305.6837 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1074.4333	0.1455	156.2800 (264)
Space and water heating			461.9637 (265)
Pumps, fans and electric keep-hot	667.1290	0.1387	92.5390 (267)
Energy for lighting	348.1537	0.1443	50.2493 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1889.8996	0.1358	-256.5796
PV Unit electricity exported	-2860.0088	0.1240	-354.5094
Total			-611.0890 (269)
Total CO2, kg/year			-6.3370 (272)
CO2 emissions per m2			-0.0300 (273)
EI value			100.0350
EI rating			100 (274)
EI band			A

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

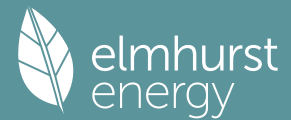
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	100.4600 (1b)	x 2.4900 (2b)	= 250.1454 (1b) -
First floor	97.4600 (1c)	x 3.3400 (2c)	= 325.5164 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	197.9200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 575.6618 (5)

2. Ventilation rate

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

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Measured/design AP50 3.0000 (17)
 Infiltration rate 0.1500 (18)
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.2000	6.0000	6.0000	5.4000	5.2000	4.6000	4.5000	4.4000	4.8000	5.6000	5.7000	6.0000 (22)
Wind factor	1.5500	1.5000	1.5000	1.3500	1.3000	1.1500	1.1250	1.1000	1.2000	1.4000	1.4250	1.5000 (22a)
Adj infilt rate	0.1976	0.1913	0.1913	0.1721	0.1658	0.1466	0.1434	0.1403	0.1530	0.1785	0.1817	0.1913 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2926	0.2863	0.2863	0.2671	0.2607	0.2416	0.2384	0.2352	0.2480	0.2735	0.2767	0.2863 (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
Window (Uw = 1.20)			37.7700	1.1450	43.2481		(27)
Door			2.1000	1.2000	2.5200		(26a)
10-12			2.3400	1.2357	2.8916		(27a)
13-15			2.3400	1.2357	2.8916		(27a)
25-29			3.8900	1.2357	4.8070		(27a)
30-31			1.5600	1.2357	1.9278		(27a)
Floor 1 P/a 0.46			100.4600	0.1600	16.0736	110.0000	11050.6000 (28a)
External Wall 1 Stone	149.5500	28.6300	120.9200	0.1800	21.7656	9.0000	1088.2800 (29a)
External Wall 2 Render	90.7700		79.5300	0.1800	14.3154	9.0000	715.7700 (29a)
External Roof 1	116.0000	10.1300	105.8700	0.1500	15.8805	9.0000	952.8300 (30)
Total net area of external elements Aum(A, m2)			456.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					126.3213		(26)...(30) + (32) = (33)
Internal Wall 1 GF			118.5600			9.0000	1067.0400 (32c)
Internal Wall 2 FF			214.5800			9.0000	1931.2200 (32c)
Internal Floor 1			97.4600			18.0000	1754.2800 (32d)
Internal Ceiling 1			97.4600			9.0000	877.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19437.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 98.2072 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	28.7000	0.0410	1.1767
E5 Ground floor (normal)	46.5000	0.0560	2.6040
E6 Intermediate floor within a dwelling	42.5000	0.0560	2.3800
E13 Gable (insulation at rafter level)	19.8600	0.0120	0.2383
E17 Corner (inverted - internal area greater than external area)	8.5000	-0.0790	-0.6715
R4 Ridge (vaulted ceiling)	18.9600	0.1200	2.2752
R7 Flat ceiling (inverted)	3.2000	0.1200	0.3840
E11 Eaves (insulation at rafter level)	32.0700	0.0020	0.0641
E2 Other lintels (including other steel lintels)	22.9500	0.0460	1.0557
E3 Sill	21.9500	0.0750	1.6462
E4 Jamb	54.8000	0.0470	2.5756
R1 Head of roof window	8.5800	0.2400	2.0592
R2 Sill of roof window	8.5800	0.2400	2.0592
R3 Jamb of roof window	30.6800	0.2400	7.3632

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.2100 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 151.5313 (37)

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

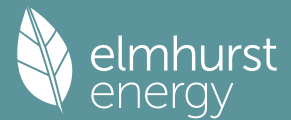
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.5895	54.3785	54.3785	50.7453	49.5343	45.9011	45.2956	44.6901	47.1122	51.9564	52.5619	54.3785 (38)
Heat transfer coeff	207.1208	205.9097	205.9097	202.2766	201.0655	197.4324	196.8269	196.2213	198.6434	203.4876	204.0931	205.9097 (39)
Average = Sum(39)m / 12 =												202.0747

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0465	1.0404	1.0404	1.0220	1.0159	0.9975	0.9945	0.9914	1.0037	1.0281	1.0312	1.0404 (40)
HLP (average)												1.0210
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9992 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	85.9543	84.6778	82.8801	79.5656	77.0837	74.3317	72.8452	74.6303	76.5739	79.5186	82.9014	85.6637 (42b)
Hot water usage for other uses	45.3449	43.6960	42.0471	40.3982	38.7493	37.1004	37.1004	38.7493	40.3982	42.0471	43.6960	45.3449 (42c)
Average daily hot water use (litres/day)												120.9158 (43)

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Daily hot water use												
Energy conte	131.2992	128.3738	124.9272	119.9638	115.8330	111.4321	109.9456	113.3796	116.9721	121.5658	126.5974	131.0087 (44)
Energy content (annual)	207.9459	182.8026	192.0085	164.2245	155.9335	137.0188	132.9697	140.3876	144.2383	164.9636	180.3613	205.1279 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 2007.9821											
Water storage loss:	31.1919	27.4204	28.8013	24.6337	23.3900	20.5528	19.9455	21.0581	21.6357	24.7445	27.0542	30.7692 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1880 (55)
Total storage loss	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (56)
If cylinder contains dedicated solar storage	36.8280	33.2640	36.8280	35.6400	36.8280	35.6400	36.8280	36.8280	35.6400	36.8280	35.6400	36.8280 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9953	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	268.0363	237.0778	250.7032	215.6229	203.2296	182.5641	180.0332	188.3816	196.9874	223.6582	238.5133	265.2183 (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												757.3382 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												757.3382
Solar input	-7.1993	-25.4463	-70.9566	-95.6549	-113.3557	-114.2146	-103.1254	-99.2135	-74.4631	-42.7281	-10.9807	-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	260.8369	211.6315	179.7466	119.9680	89.8739	68.3495	76.9077	89.1680	122.5244	180.9301	227.5326	265.2183 (64)
											Total per year (kWh/year) = Sum(64)m = 1892.6875 (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	117.2143	104.2020	110.7986	95.7234	89.6848	81.9950	81.8632	85.0740	90.1585	101.8061	106.4917	116.2773 (65)

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

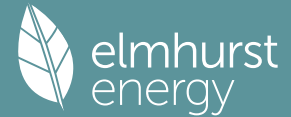
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528	179.9528 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.2848	43.7743	35.5996	26.9512	20.1464	17.0084	18.3782	23.8887	32.0633	40.7117	47.5166	50.6545 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	550.8421	556.5582	542.1540	511.4892	472.7804	436.3996	412.0950	406.3789	420.7831	451.4479	490.1567	526.5375 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945	55.9945 (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)	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685	-119.9685 (71)
Water heating gains (Table 5)	157.5461	155.0625	148.9228	132.9491	120.5440	113.8819	110.0312	114.3468	125.2202	136.8362	147.9052	156.2868 (72)
Total internal gains	873.6518	871.3737	842.6552	787.3683	729.4495	683.2686	656.4831	660.5932	694.0454	744.9746	801.5572	849.4576 (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	
East	1.4400	26.5119	0.7600	0.7000	0.7700	14.0750 (76)
South	10.3500	58.6702	0.7600	0.7000	0.7700	223.8736 (78)
West	25.9800	26.5119	0.7600	0.7000	0.7700	253.9364 (80)
North	3.8900	36.0000	0.7600	0.7000	1.0000	67.0512 (82)
East	1.5600	36.0000	0.7600	0.7000	1.0000	26.8894 (82)
South	2.3400	36.0000	0.7600	0.7000	1.0000	40.3341 (82)
West	2.3400	36.0000	0.7600	0.7000	1.0000	40.3341 (82)

Solar gains	666.4938	1072.9888	1668.1321	2398.3474	2715.6365	3019.9398	2635.7272	2459.1507	2013.2240	1295.5041	790.6187	534.4836 (83)
Total gains	1540.1456	1944.3625	2510.7873	3185.7156	3445.0860	3703.2085	3292.2103	3119.7438	2707.2694	2040.4786	1592.1759	1383.9411 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	26.0679	26.2213	26.2213	26.6922	26.8530	27.3471	27.4313	27.5159	27.1804	26.5334	26.4546	26.2213
alpha	2.7379	2.7481	2.7481	2.7795	2.7902	2.8231	2.8288	2.8344	2.8120	2.7689	2.7636	2.7481
util living area	0.9170	0.8641	0.7693	0.6293	0.5052	0.3584	0.3084	0.3120	0.4552	0.7023	0.8632	0.9282 (86)
Living	19.5650	19.8446	20.1994	20.5441	20.7347	20.8461	20.8685	20.8691	20.8099	20.5310	20.0463	19.5568
Non living	18.3900	18.7356	19.1594	19.5680	19.7827	19.9097	19.9334	19.9369	19.8753	19.5682	18.9986	18.3859
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2659	19.8446	20.1994	20.5441	20.7347	20.8461	20.8685	20.8691	20.8099	20.5310	20.0463	19.7586 (87)
Th 2	20.0448	20.0498	20.0498	20.0650	20.0701	20.0854	20.0879	20.0905	20.0803	20.0600	20.0574	20.0498 (88)
util rest of house	0.9051	0.8465	0.7437	0.5962	0.4656	0.3152	0.2579	0.2591	0.4014	0.6600	0.8414	0.9172 (89)
MIT 2	19.3851	18.7356	19.1594	19.5680	19.7827	19.9097	19.9334	19.9369	19.8753	19.5682	18.9986	18.6858 (90)
Living area fraction									flA = Living area / (4) =			0.2790 (91)
MIT	19.6308	19.0450	19.4496	19.8403	20.0483	20.1710	20.1943	20.1970	20.1360	19.8368	19.2909	18.9851 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6308	19.0450	19.4496	19.8403	20.0483	20.1710	20.1943	20.1970	20.1360	19.8368	19.2909	18.9851 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8992	0.8248	0.7257	0.5879	0.4646	0.3193	0.2639	0.2654	0.4047	0.6491	0.8204	0.9020 (94)
Useful gains	1384.8838	1603.6394	1822.1823	1872.7412	1600.6983	1182.3969	868.7786	827.9737	1095.7401	1324.4208	1306.2255	1248.3804 (95)
Ext temp.	6.3000	6.6000	7.5000	9.0000	11.4000	14.0000	15.7000	15.9000	14.3000	11.8000	9.2000	6.8000 (96)
Heat loss rate W	2761.0918	2562.5482	2460.5291	2192.7416	1738.8691	1218.3469	884.5985	843.1593	1159.2906	1635.3898	2059.4878	2509.0293 (97)
Space heating kWh	1023.8988	644.3867	474.9300	230.4003	102.7991	0.0000	0.0000	0.0000	0.0000	231.3609	542.3489	937.9228 (98a)
Space heating requirement - total per year (kWh/year)												4188.0474
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	1023.8988	644.3867	474.9300	230.4003	102.7991	0.0000	0.0000	0.0000	0.0000	231.3609	542.3489	937.9228 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4188.0474
Space heating per m2												(98c) / (4) = 21.1603 (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)

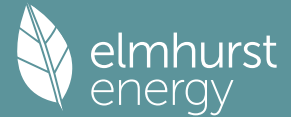
Efficiency of main space heating system 1 (in %) 276.2024 (206)

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	1023.8988	644.3867	474.9300	230.4003	102.7991	0.0000	0.0000	0.0000	0.0000	231.3609	542.3489	937.9228 (98)
Space heating efficiency (main heating system 1)	276.2024	276.2024	276.2024	276.2024	276.2024	0.0000	0.0000	0.0000	0.0000	276.2024	276.2024	276.2024 (210)
Space heating fuel (main heating system)	370.7059	233.3023	171.9500	83.4172	37.2187	0.0000	0.0000	0.0000	0.0000	83.7650	196.3592	339.5780 (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	260.8369	211.6315	179.7466	119.9680	89.8739	68.3495	76.9077	89.1680	122.5244	180.9301	227.5326	265.2183 (64)
Efficiency of water heater (217)m	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412	188.7412 (216)
Fuel for water heating, kWh/month	138.1982	112.1278	95.2344	63.5622	47.6175	36.2133	40.7477	47.2435	64.9166	95.8615	120.5527	140.5195 (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	56.6603	51.1770	56.6603	54.8325	56.6603	54.8325	56.6603	56.6603	54.8325	56.6603	54.8325	56.6603 (231)
Lighting	43.1387	34.6074	31.1602	22.8293	17.6340	14.4071	16.0863	20.9096	27.1595	35.6347	40.2493	44.3376 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-119.0404	-147.0493	-204.0337	-217.2675	-213.9596	-193.9350	-187.8655	-185.5714	-174.3781	-161.8913	-123.2007	-99.3037 (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	-62.3901	-113.1066	-235.6419	-384.9362	-484.4715	-555.3551	-488.7749	-449.8123	-335.5968	-183.4191	-84.2273	-46.7844 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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												1516.2963	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.7412	
Water heating fuel used												1002.7949	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)													
mechanical ventilation fans (SFP = 0.8360)												587.1290	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												667.1290	(231)
Electricity for lighting (calculated in Appendix L)												348.1537	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-5452.0127	(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												-1917.6387	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1516.2963	21.5100	326.1553	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1002.7949	21.5100	215.7012	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	587.1290	21.5100	126.2914	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	348.1537	21.5100	74.8879	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2027.4962	21.5100	-436.1144	
PV Unit electricity exported	-3424.5165	5.5900	-191.4305	
Total			-627.5449	(252)
Total energy cost			132.6990	(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	1516.2963	0.1565	237.2968	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1002.7949	0.1462	146.6375	(264)
Space and water heating			383.9343	(265)
Pumps, fans and electric keep-hot	667.1290	0.1387	92.5390	(267)
Energy for lighting	348.1537	0.1443	50.2493	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2027.4962	0.1364	-276.4510	
PV Unit electricity exported	-3424.5165	0.1249	-427.6941	
Total			-704.1450	(269)
Total CO2, kg/year			-177.4223	(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	1516.2963	1.5793	2394.7049	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1002.7949	1.5409	1545.2450	(278)
Space and water heating			3939.9499	(279)
Pumps, fans and electric keep-hot	667.1290	1.5128	1009.2327	(281)
Energy for lighting	348.1537	1.5338	534.0098	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2027.4962	1.5040	-3049.4055	
PV Unit electricity exported	-3424.5165	0.4584	-1569.8109	
Total			-4619.2164	(283)
Total Primary energy kWh/year			863.9761	(286)

