

Full SAP Calculation Printout



Property Reference	7358-0001-GF-80MP				Issued on Date	04/09/2024
Assessment Reference	Proposed		Prop Type Ref			
Property	Proposed dwelling adjacent, 80 Mount Pleasant, Reading, RG1 2DT					
SAP Rating	81 B	DER	4.07	TER	12.53	
Environmental	96 A	% DER < TER				67.52
CO ₂ Emissions (t/year)	0.33	DFEE	39.03	TFEE	40.20	
Compliance Check	See BREL	% DFEE < TFEE				2.91
% DPER < TPER	29.98	DPER	46.28	TPER	66.10	
Assessor Details	Mr. James Turner				Assessor ID	7358-0001
Client	052, Greg Farrell					

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)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.0390 (5)

2. Ventilation rate

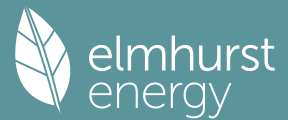
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.1568 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0100 (17)
Infiltration rate	0.4073 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3768 (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	0.4804	0.4710	0.4616	0.4145	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4239	0.4427 (22b)
Effective ac	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980 (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
Entrance door			1.9100	1.4000	2.6740		(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973		(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275		(27)
Opening 8			1.2900	1.2357	1.5941		(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008 (28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496 (28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692 (29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1200	0.7512	10.3700	64.9162 (29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148	61.7800	5119.0908 (29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172 (29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812 (30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019 (30)
Total net area of external elements A _{um} (A, m ²)			228.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.5339		(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946 (32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130 (32)
Internal Wall 1			72.1300			75.0000	5409.7500 (32c)
Internal Wall 2			59.5400			9.0000	535.8600 (32c)

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Internal Floor 1	27.7900	18.0000	500.2200 (32d)
Internal Floor 2	30.3600	18.0000	546.4800 (32d)
Internal Ceiling 1	27.7900	9.0000	250.1100 (32e)
Internal Ceiling 2	30.3600	9.0000	273.2400 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 19439.7945 (34)
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 189.1951 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	10.4400	0.0500	0.5220
E2 Other lintels (including other steel lintels)	9.5300	0.0200	0.1906
E3 Sill	24.9000	0.0150	0.3735
E4 Jamb	14.9500	0.0600	0.8970
E5 Ground floor (normal)	41.1800	0.0010	0.0412
E6 Intermediate floor within a dwelling	14.4000	0.0410	0.5904
E16 Corner (normal)	4.2000	0.2400	1.0080
E18 Party wall between dwellings	1.6500	0.0610	0.1006
R1 Head of roof window	1.6500	0.0600	0.0990
R2 Sill of roof window	4.6800	0.0560	0.2621
R3 Jamb of roof window	12.7700	0.0600	0.7662
E5 Ground floor (normal)	4.2000	0.1800	0.7560
E16 Corner (normal)	8.4700	0.0590	0.4997
E10 Eaves (insulation at ceiling level)	7.1700	0.0430	0.3083
E12 Gable (insulation at ceiling level)	9.9000	0.0180	0.1782
E11 Eaves (insulation at rafter level)	2.8800	0.0420	0.1210
E13 Gable (insulation at rafter level)	6.9400	0.0430	0.2984
P1 Party wall - Ground floor	10.0000	0.0430	0.4300
E18 Party wall between dwellings	14.3400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	7.1700	0.0400	0.2868
P4 Party wall - Roof (insulation at ceiling level)	2.4000	-0.0760	-0.1824
E17 Corner (inverted - internal area greater than external area)	9.3000	0.1200	1.1160
R6 Flat ceiling	3.3000	0.3200	1.0560
R10 All other roof or room-in-roof junctions			9.7186 (36)

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 0.0000
Point Thermal bridges (36a) =
Total fabric heat loss (33) + (36) + (36a) = 63.2526 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.7934	51.4162	51.0466	49.3103	48.9855	47.4732	47.4732	47.1932	48.0557	48.9855	49.6426	50.3297 (38)
Heat transfer coeff	115.0459	114.6688	114.2992	112.5629	112.2380	110.7258	110.7258	110.4457	111.3083	112.2380	112.8952	113.5822 (39)
Average = Sum(39)m / 12 =												112.5613
HLP	1.1197	1.1160	1.1124	1.0955	1.0923	1.0776	1.0776	1.0749	1.0833	1.0923	1.0987	1.1054 (40)
HLP (average)												1.0955
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

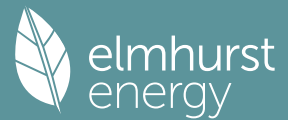
4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7636 (42)
Hot water usage for mixer showers	79.3752	78.1823	76.4441	73.1183	70.6640	67.9269	66.3712	68.0963	69.9873	72.9260	76.3232	79.0711 (42a)
Hot water usage for baths	30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615 (42b)
Hot water usage for other uses	42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317 (42c)
Average daily hot water use (litres/day)												140.4554 (43)
Daily hot water use	152.7714	149.5649	145.6284	139.5667	134.6716	129.3980	127.3154	131.2343	135.3753	140.9189	147.0762	152.3642 (44)
Energy conte	241.9525	212.9784	223.8254	191.0599	181.2938	159.1099	153.9769	162.4955	166.9313	191.2256	209.5370	238.5656 (45)
Energy content (annual)										Total = Sum(45)m =		2332.9519
Distribution loss (46)m = $0.15 \times (45)\text{m}$	36.2929	31.9468	33.5738	28.6590	27.1941	23.8665	23.0965	24.3743	25.0397	28.6838	31.4306	35.7848 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (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	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2882.7879 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												0.0000 (64a)
Heat gains from water heating, kWh/month	117.8079	104.5587	111.7807	99.6810	97.6389	89.0577	88.5561	91.3885	91.6583	100.9412	105.8247	116.6818 (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	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.8512	154.8353	139.8512	144.5129	139.8512	144.5129	139.8512	139.8512	144.5129	139.8512	144.5129	139.8512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6984	263.4036	256.5865	242.0737	223.7539	206.5359	195.0332	192.3279	199.1450	213.6578	231.9776	249.1957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178 (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)

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Losses e.g. evaporation (negative values) (Table 5)												
	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	(71)
Water heating gains (Table 5)												
	158.3440	155.5933	150.2428	138.4458	131.2351	123.6912	119.0270	122.8340	127.3031	135.6737	146.9787	(72)
Total internal gains												
	626.3471	641.2857	614.1341	592.4860	562.2937	539.1935	518.3648	519.4666	535.4146	556.6363	590.9228	(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		
West					4.7500	19.6403	0.6300	0.7000	0.7700	28.5110 (80)		
East					4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (76)		
South					1.1900	46.7521	0.6300	0.7000	0.7700	17.0028 (78)		
West					2.8000	19.6403	0.6300	0.7000	0.7700	16.8065 (80)		
South					1.2900	42.0754	0.6300	0.7000	1.0000	21.5426 (82)		
Solar gains	111.9538	211.2486	333.1880	469.7881	565.8460	575.8973	549.5835	477.9373	381.6437	246.3863	138.0901	93.0869 (83)
Total gains	738.3008	852.5342	947.3221	1062.2741	1128.1397	1115.0908	1067.9484	997.4039	917.0583	803.0226	729.0129	706.4177 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	46.9373	47.0916	47.2439	47.9727	48.1115	48.7686	48.7686	48.8923	48.5134	48.1115	47.8315	47.5421
alpha	4.1292	4.1394	4.1496	4.1982	4.2074	4.2512	4.2512	4.2595	4.2342	4.2074	4.1888	4.1695
util living area												
	0.9880	0.9776	0.9554	0.8931	0.7753	0.5984	0.4472	0.4948	0.7313	0.9246	0.9780	0.9899 (86)
MIT	19.7627	19.9367	20.1906	20.5211	20.7606	20.8865	20.9179	20.9132	20.8312	20.5096	20.0871	19.7430 (87)
Th 2	19.9848	19.9878	19.9907	20.0045	20.0071	20.0191	20.0191	20.0214	20.0145	20.0071	20.0019	19.9964 (88)
util rest of house												
	0.9851	0.9722	0.9444	0.8671	0.7243	0.5196	0.3517	0.3961	0.6574	0.9003	0.9717	0.9875 (89)
MIT 2	18.5406	18.7630	19.0837	19.4962	19.7677	19.8997	19.9221	19.9221	19.8509	19.4937	18.9663	18.5243 (90)
Living area fraction												
	0.9810	0.9722	0.9444	0.8671	0.7243	0.5196	0.3517	0.3961	0.6574	0.9003	0.9717	0.9875 (89)
MIT	18.9810	19.1860	19.4826	19.8656	20.1255	20.2554	20.2810	20.2792	20.2042	19.8598	19.3702	18.9635 (92)
Temperature adjustment												
	18.9810	19.1860	19.4826	19.8656	20.1255	20.2554	20.2810	20.2792	20.2042	19.8598	19.3702	18.9635 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9667	0.9377	0.8630	0.7309	0.5393	0.3777	0.4228	0.6728	0.8961	0.9666	0.9841 (94)
Useful gains	724.4676	824.1651	888.2625	916.7309	824.5168	601.3763	403.3532	421.6824	617.0045	719.5594	704.6749	695.1674 (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												
	1688.9944	1638.1610	1483.8992	1234.3164	945.6607	626.1934	407.5775	428.4449	679.4487	1039.3019	1385.2500	1676.8715 (97)
Space heating kWh												
	717.6079	547.0052	443.1537	228.6615	90.1311	0.0000	0.0000	0.0000	0.0000	237.8884	490.0141	730.3878 (98a)
Space heating requirement - total per year (kWh/year)												
												3484.8498
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												
	717.6079	547.0052	443.1537	228.6615	90.1311	0.0000	0.0000	0.0000	0.0000	237.8884	490.0141	730.3878 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												3484.8498
Space heating per m ²												
										(98c) / (4) =		33.9158 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												
	717.6079	547.0052	443.1537	228.6615	90.1311	0.0000	0.0000	0.0000	0.0000	237.8884	490.0141	730.3878 (98)
Space heating efficiency (main heating system 1)												
	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)												
	422.1223	321.7678	260.6787	134.5068	53.0183	0.0000	0.0000	0.0000	0.0000	139.9344	288.2436	429.6399 (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												
	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (64)
Efficiency of water heater												
	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month												
	169.7946	150.0927	159.1317	138.9717	134.1131	120.1776	118.0443	123.0552	124.7784	139.9553	149.8406	167.8023 (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												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting												
	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
	-25.7715	-42.6838	-72.0898	-90.8259	-102.6980	-94.5489	-92.7608	-83.5677	-67.6657	-51.4592	-29.9311	-21.4269 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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	-5.0941	-13.0936	-33.1198	-63.1404	-97.4060	-105.9031	-103.4959	-81.5661	-52.5185	-22.7309	-7.5496	-3.8006	(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												2049.9116	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1695.7576	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												234.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1364.8479	(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												2615.3387	(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	2049.9116	0.1556	318.9927 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1695.7576	0.1410	239.1554 (264)
Space and water heating			558.1481 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	234.5173	0.1443	33.8481 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-775.4293	0.1327	-102.8719
PV Unit electricity exported	-589.4185	0.1201	-70.7795
Total			-173.6514 (269)
Total CO2, kg/year			418.3447 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.0700 (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	2049.9116	1.5761	3230.8809 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1695.7576	1.5215	2580.0788 (278)
Space and water heating			5810.9596 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	234.5173	1.5338	359.7105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-775.4293	1.4902	-1155.5561
PV Unit electricity exported	-589.4185	0.4405	-259.6107
Total			-1415.1669 (283)
Total Primary energy kWh/year			4755.5032 (286)
Dwelling Primary energy Rate (DPER)			46.2800 (287)

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

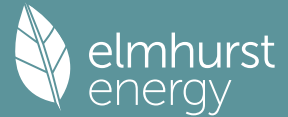
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.0390 (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)

Full SAP Calculation Printout



Number of chimneys / flues attached to closed fire
Number of flues attached to solid fuel boiler
Number of flues attached to other heater
Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (6c)
0 * 20 = 0.0000 (6d)
0 * 35 = 0.0000 (6e)
0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1568 (8)
Pressure test
Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered
Blower Door
Yes
5.0000 (17)
0.4068 (18)
1 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3763 (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													
	0.4798	0.4704	0.4610	0.4140	0.4046	0.3575	0.3575	0.3481	0.3763	0.4046	0.4234	0.4422	(22b)
Effective ac	0.6151	0.6106	0.6063	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5978	(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			1.9100	1.0000	1.9100			(26a)
TER Opening Type (Uw = 1.20)			13.4200	1.1450	15.3664			(27)
Opening 8			1.2900	1.5918	2.0534			(27a)
Basement floor			27.7900	0.1300	3.6127			(28)
Kitchen floor			14.2300	0.1300	1.8499			(28a)
Basement wall	23.1600		23.1600	0.1800	4.1688			(29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1800	1.1268			(29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148			(29a)
Kitchen adjoining wall	11.8800		11.8800	0.1800	2.1384			(29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396			(30)
External Roof 2	16.3600	1.2900	15.0700	0.1100	1.6577			(30)
Total net area of external elements Aum(A, m2)			228.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1385			(33)
Basement party wall			14.5800	0.0000	0.0000			(32)
Party Wall 2			35.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 189.1951 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	10.4400	0.0500	0.5220	
E2 Other lintels (including other steel lintels)	9.5300	0.0500	0.4765	
E3 Sill	24.9000	0.0500	1.2450	
E4 Jamb	14.9500	0.1600	2.3920	
E5 Ground floor (normal)	41.1800	0.0000	0.0000	
E6 Intermediate floor within a dwelling	14.4000	0.0900	1.2960	
E16 Corner (normal)	4.2000	0.0600	0.2520	
R1 Head of roof window	1.6500	0.0800	0.1320	
R2 Sill of roof window	1.6500	0.0600	0.0990	
R3 Jamb of roof window	4.6800	0.0800	0.3744	
E5 Ground floor (normal)	12.7700	0.1600	2.0432	
E16 Corner (normal)	4.2000	0.0900	0.3780	
E10 Eaves (insulation at ceiling level)	8.4700	0.0600	0.5082	
E12 Gable (insulation at ceiling level)	7.1700	0.0600	0.4302	
E11 Eaves (insulation at rafter level)	9.9000	0.0400	0.3960	
E13 Gable (insulation at rafter level)	2.8800	0.0800	0.2304	
P1 Party wall - Ground floor	6.9400	0.0800	0.5552	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.1200	0.8604	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
R6 Flat ceiling	9.3000	0.0600	0.5580	
R10 All other roof or room-in-roof junctions	3.3000	0.0800	0.2640	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3965 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 65.5350 (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	51.7695	51.3933	51.0246	49.2926	48.9685	47.4600	47.4600	47.1806	48.0411	48.9685	49.6241	50.3094	(38)
Heat transfer coeff	117.3045	116.9283	116.5596	114.8276	114.5035	112.9950	112.9950	112.7156	113.5760	114.5035	115.1591	115.8444	(39)
Average = Sum(39)m / 12 =												114.8260	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1416	1.1380	1.1344	1.1175	1.1144	1.0997	1.0997	1.0970	1.1054	1.1144	1.1208	1.1274	(40)
HLP (average)												1.1175	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7636 (42)
Hot water usage for mixer showers												
	70.5557	69.4954	67.9503	64.9941	62.8124	60.3795	58.9966	60.5300	62.2109	64.8231	67.8429	70.2854 (42a)
Hot water usage for baths												
	30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615 (42b)
Hot water usage for other uses												
	42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317 (42c)
Average daily hot water use (litres/day)												132.3242 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	143.9519	140.8780	137.1346	131.4425	126.8200	121.8506	119.9408	123.6680	127.5989	132.8160	138.5959	143.5786 (44)
Energy conte	227.9846	200.6084	210.7708	179.9382	170.7241	149.8295	145.0580	153.1269	157.3423	180.2301	197.4552	224.8093 (45)

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Space heating kWh	710.6236	545.7055	448.1209	238.7755	99.0469	0.0000	0.0000	0.0000	0.0000	246.4051	490.5088	723.0164 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3502.2027
Space heating per m2												(98c) / (4) = 34.0847 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	710.6236	545.7055	448.1209	238.7755	99.0469	0.0000	0.0000	0.0000	0.0000	246.4051	490.5088	723.0164 (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)	769.9064	591.2302	485.5047	258.6950	107.3098	0.0000	0.0000	0.0000	0.0000	266.9611	531.4288	783.3330 (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	244.9721	216.5589	230.1419	202.8576	196.9149	177.7580	175.8110	182.7076	184.5875	205.4128	217.8524	242.3942 (64)
Efficiency of water heater (217)m	86.3047	86.0431	85.5270	84.4263	82.6017	79.8000	79.8000	79.8000	79.8000	84.4689	85.8232	79.8000 (216)
Fuel for water heating, kWh/month	283.8455	251.6867	269.0868	240.2776	238.3908	222.7543	220.3145	228.9569	231.3126	243.1817	253.8387	280.6961 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-28.8175	-42.1792	-62.9026	-73.4425	-81.5231	-76.9065	-75.9401	-70.5349	-61.4056	-49.4152	-32.2202	-24.7347 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-11.8726	-25.3795	-51.2140	-78.0694	-104.3738	-105.3218	-104.1082	-87.6397	-63.5545	-36.6970	-15.9775	-9.3603 (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												3794.3691 (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												2964.3421 (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)												234.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1373.5904 (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												5705.6382 (238)

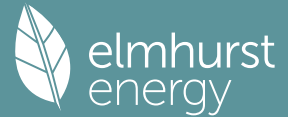
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3794.3691	0.2100	796.8175 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2964.3421	0.2100	622.5118 (264)
Space and water heating			1419.3294 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	234.5173	0.1443	33.8481 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-680.0221	0.1338	-91.0003
PV Unit electricity exported	-693.5683	0.1255	-87.0123
Total			-178.0127 (269)
Total CO2, kg/year			1287.0940 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5300 (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	3794.3691	1.1300	4287.6371 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2964.3421	1.1300	3349.7066 (278)
Space and water heating			7637.3437 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)

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Energy for lighting	234.5173	1.5338	359.7105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-680.0221	1.4945	-1016.3145
PV Unit electricity exported	-693.5683	0.4605	-319.3801
Total			-1335.6946 (283)
Total Primary energy kWh/year			6791.4604 (286)
Target Primary Energy Rate (TPER)			66.1000 (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)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.0390 (5)

2. Ventilation rate

	m ³ per hour											
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											40.0000 / (5) = 0.1568 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0100 (17)
Infiltration rate												0.4073 (18)
Number of sides sheltered												1 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3768 (21)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4804	0.4710	0.4616	0.4145	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4239	0.4427 (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	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980 (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
Entrance door			1.9100	1.4000	2.6740		(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973		(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275		(27)
Opening 8			1.2900	1.2357	1.5941		(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008 (28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496 (28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692 (29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1200	0.7512	10.3700	64.9162 (29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148	61.7800	5119.0908 (29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172 (29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812 (30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019 (30)
Total net area of external elements Aum (A, m ²)			228.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.5339		(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946 (32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130 (32)
Internal Wall 1			72.1300			75.0000	5409.7500 (32c)
Internal Wall 2			59.5400			9.0000	535.8600 (32c)
Internal Floor 1			27.7900			18.0000	500.2200 (32d)
Internal Floor 2			30.3600			18.0000	546.4800 (32d)
Internal Ceiling 1			27.7900			9.0000	250.1100 (32e)
Internal Ceiling 2			30.3600			9.0000	273.2400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19439.7945 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.1951 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.4400	0.0500	0.5220	
E3 Sill				9.5300	0.0200	0.1906	
E4 Jamb				24.9000	0.0150	0.3735	
E5 Ground floor (normal)				14.9500	0.0600	0.8970	

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E6 Intermediate floor within a dwelling	41.1800	0.0010	0.0412
E16 Corner (normal)	14.4000	0.0410	0.5904
E18 Party wall between dwellings	4.2000	0.2400	1.0080
R1 Head of roof window	1.6500	0.0610	0.1006
R2 Sill of roof window	1.6500	0.0600	0.0990
R3 Jamb of roof window	4.6800	0.0560	0.2621
E5 Ground floor (normal)	12.7700	0.0600	0.7662
E16 Corner (normal)	4.2000	0.1800	0.7560
E10 Eaves (insulation at ceiling level)	8.4700	0.0590	0.4997
E12 Gable (insulation at ceiling level)	7.1700	0.0430	0.3083
E11 Eaves (insulation at rafter level)	9.9000	0.0180	0.1782
E13 Gable (insulation at rafter level)	2.8800	0.0420	0.1210
P1 Party wall - Ground floor	6.9400	0.0430	0.2984
E18 Party wall between dwellings	10.0000	0.0430	0.4300
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.0400	0.2868
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0760	-0.1824
R6 Flat ceiling	9.3000	0.1200	1.1160
R10 All other roof or room-in-roof junctions	3.3000	0.3200	1.0560
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.7186 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	63.2526 (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	51.7934	51.4162	51.0466	49.3103	48.9855	47.4732	47.4732	47.1932	48.0557	48.9855	49.6426	50.3297 (38)
Heat transfer coeff	115.0459	114.6688	114.2992	112.5629	112.2380	110.7258	110.7258	110.4457	111.3083	112.2380	112.8952	113.5822 (39)
Average = Sum(39)m / 12 =												112.5613
HLP	1.1197	1.1160	1.1124	1.0955	1.0923	1.0776	1.0776	1.0749	1.0833	1.0923	1.0987	1.1054 (40)
HLP (average)												1.0955
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7636 (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												
30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615	30.3615 (42b)
Hot water usage for other uses												
42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317	42.9317 (42c)
Average daily hot water use (litres/day)												67.2742 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	73.3962	71.3826	69.1843	66.4484	64.0076	61.4711	60.9442	63.1380	65.3881	67.9929	70.7530	73.2932 (44)
Energy conte	116.2416	101.6478	106.3337	90.9645	86.1665	75.5858	73.7067	78.1781	80.6300	92.2657	100.8006	114.7594 (45)
Energy content (annual)										Total = Sum(45)m =		1117.2806
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
98.8054	86.4007	90.3836	77.3198	73.2415	64.2480	62.6507	66.4514	68.5355	78.4259	85.6805	97.5455	97.5455 (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												
98.8054	86.4007	90.3836	77.3198	73.2415	64.2480	62.6507	66.4514	68.5355	78.4259	85.6805	97.5455	97.5455 (64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		949.6885 (64)
Electric shower(s)												950 (64)
56.5034	50.3450	54.9748	52.4618	53.4462	50.9825	52.6819	53.4462	52.4618	54.9748	53.9410	56.5034	56.5034 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												642.7225 (64a)
Heat gains from water heating, kWh/month												
38.8272	34.1864	36.3396	32.4454	31.6719	28.8076	28.8332	29.9744	30.2493	33.3502	34.9054	38.5122	38.5122 (65)

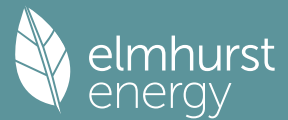
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
139.8512	154.8353	139.8512	144.5129	139.8512	144.5129	139.8512	139.8512	139.8512	144.5129	139.8512	144.5129	139.8512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
260.6984	263.4036	256.5865	242.0737	223.7539	206.5359	195.0332	192.3279	199.1450	213.6578	231.9776	249.1957	249.1957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178 (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)												
-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427 (71)
Water heating gains (Table 5)												
52.1871	50.8726	48.8436	45.0631	42.5698	40.0106	38.7542	40.2882	42.0129	44.8255	48.4797	51.7637	51.7637 (72)
Total internal gains												
517.1902	533.5650	509.7348	496.1032	470.6284	455.5129	438.0921	436.9208	450.1244	462.7880	489.4238	505.2641	505.2641 (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
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West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110 (80)
East	4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (76)
South	1.1900	46.7521	0.6300	0.7000	0.7700	17.0028 (78)
West	2.8000	19.6403	0.6300	0.7000	0.7700	16.8065 (80)
South	1.2900	42.0754	0.6300	0.7000	1.0000	21.5426 (82)

Solar gains	111.9538	211.2486	333.1880	469.7881	565.8460	575.8973	549.5835	477.9373	381.6437	246.3863	138.0901	93.0869 (83)
Total gains	629.1439	744.8136	842.9228	965.8913	1036.4744	1031.4102	987.6757	914.8581	831.7681	709.1743	627.5139	598.3511 (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	46.9373	47.0916	47.2439	47.9727	48.1115	48.7686	48.7686	48.8923	48.5134	48.1115	47.8315	47.5421
alpha	4.1292	4.1394	4.1496	4.1982	4.2074	4.2512	4.2512	4.2595	4.2342	4.2074	4.1888	4.1695
util living area	0.9933	0.9859	0.9693	0.9175	0.8108	0.6364	0.4806	0.5342	0.7754	0.9479	0.9870	0.9945 (86)
MIT	19.3141	19.5528	19.9054	20.3777	20.7338	20.9314	20.9835	20.9746	20.8386	20.3522	19.7587	19.2867 (87)
Th 2	19.9848	19.9878	19.9907	20.0045	20.0071	20.0191	20.0191	20.0214	20.0145	20.0071	20.0019	19.9964 (88)
util rest of house	0.9916	0.9824	0.9613	0.8957	0.7630	0.5559	0.3793	0.4298	0.7046	0.9296	0.9831	0.9931 (89)
MIT 2	18.4494	18.6882	19.0376	19.5013	19.8218	19.9842	20.0139	20.0126	19.9198	19.4881	18.9046	18.4308 (90)
Living area fraction	FLA = Living area / (4) =											
MIT	18.7610	18.9998	19.3503	19.8172	20.1505	20.3255	20.3634	20.3593	20.2509	19.7995	19.2124	18.7393 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7610	18.9998	19.3503	19.8172	20.1505	20.3255	20.3634	20.3593	20.2509	19.7995	19.2124	18.7393 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9887	0.9778	0.9549	0.8909	0.7705	0.5822	0.4156	0.4670	0.7232	0.9249	0.9789	0.9907 (94)
Useful gains	622.0387	728.2680	804.8888	860.5447	798.6310	600.5115	410.4886	427.2398	601.5270	655.9284	614.2824	592.7852 (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	1663.6781	1616.8118	1468.7822	1228.8660	948.4656	633.9649	416.7002	437.2846	684.6464	1032.5341	1367.4366	1651.4017 (97)
Space heating kWh	774.9797	597.1014	493.9368	265.1914	111.4770	0.0000	0.0000	0.0000	0.0000	280.1947	542.2710	787.6107 (98a)
Space heating requirement - total per year (kWh/year)												3852.7626
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	774.9797	597.1014	493.9368	265.1914	111.4770	0.0000	0.0000	0.0000	0.0000	280.1947	542.2710	787.6107 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3852.7626
Space heating per m2												(98c) / (4) = 37.4965 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1040.8224	819.3708	839.3876	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8399	0.9022	0.8728	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	874.2328	739.2181	732.6577	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1125.8656	1078.4534	998.2687	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	181.1756	252.3911	197.6146	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	fc = cooled area / (4) =											
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.2939	63.0978	49.4037	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												157.7953 (107)
Energy for space heating												37.4965 (99)
Energy for space cooling												1.5357 (108)
Total												39.0322 (109)
Fabric Energy Efficiency (DFEE)												39.0 (109)

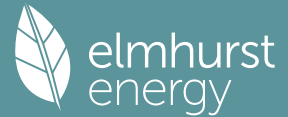
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	255.0390 (5)

2. Ventilation rate

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												m3 per hour		
Number of open chimneys												0 * 80 =	0.0000 (6a)	
Number of open flues												0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)	
Number of blocked chimneys												0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans												4 * 10 =	40.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
												Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												40.0000 / (5) =	0.1568 (8)	
Pressure test												Yes		
Pressure Test Method												Blower Door		
Measured/design AP50												5.0000 (17)		
Infiltration rate												0.4068 (18)		
Number of sides sheltered												1 (19)		
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3763 (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	0.4798	0.4704	0.4610	0.4140	0.4046	0.3575	0.3575	0.3481	0.3763	0.4046	0.4234	0.4422	(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	0.6151	0.6106	0.6063	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5978	(25)	

3. Heat losses and heat loss parameter

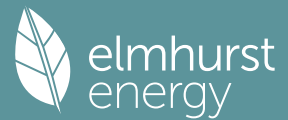
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			1.9100	1.0000	1.9100			(26a)
TER Opening Type (Uw = 1.20)			13.4200	1.1450	15.3664			(27)
Opening 8			1.2900	1.5918	2.0534			(27a)
Basement floor			27.7900	0.1300	3.6127			(28)
Kitchen floor			14.2300	0.1300	1.8499			(28a)
Basement wall	23.1600		23.1600	0.1800	4.1688			(29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1800	1.1268			(29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148			(29a)
Kitchen adjoining wall	11.8800		11.8800	0.1800	2.1384			(29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396			(30)
External Roof 2	16.3600	1.2900	15.0700	0.1100	1.6577			(30)
Total net area of external elements Aum(A, m2)			228.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.1385			(33)
Basement party wall			14.5800	0.0000	0.0000			(32)
Party Wall 2			35.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								189.1951 (35)

E2 Other lintels (including other steel lintels)	10.4400	0.0500	0.5220										
E3 Sill	9.5300	0.0500	0.4765										
E4 Jamb	24.9000	0.0500	1.2450										
E5 Ground floor (normal)	14.9500	0.1600	2.3920										
E6 Intermediate floor within a dwelling	41.1800	0.0000	0.0000										
E16 Corner (normal)	14.4000	0.0900	1.2960										
E18 Party wall between dwellings	4.2000	0.0600	0.2520										
R1 Head of roof window	1.6500	0.0800	0.1320										
R2 Sill of roof window	1.6500	0.0600	0.0990										
R3 Jamb of roof window	4.6800	0.0800	0.3744										
E5 Ground floor (normal)	12.7700	0.1600	2.0432										
E16 Corner (normal)	4.2000	0.0900	0.3780										
E10 Eaves (insulation at ceiling level)	8.4700	0.0600	0.5082										
E12 Gable (insulation at ceiling level)	7.1700	0.0600	0.4302										
E11 Eaves (insulation at rafter level)	9.9000	0.0400	0.3960										
E13 Gable (insulation at rafter level)	2.8800	0.0800	0.2304										
P1 Party wall - Ground floor	6.9400	0.0800	0.5552										
E18 Party wall between dwellings	10.0000	0.0600	0.6000										
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000										
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.1200	0.8604										
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160										
R6 Flat ceiling	9.3000	0.0600	0.5580										
R10 All other roof or room-in-roof junctions	3.3000	0.0800	0.2640										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.3965 (36)										
Point Thermal bridges		(36a) =	0.0000										
Total fabric heat loss		(33) + (36) + (36a) =	65.5350 (37)										
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.7695	Feb 51.3933	Mar 51.0246	Apr 49.2926	May 48.9685	Jun 47.4600	Jul 47.4600	Aug 47.1806	Sep 48.0411	Oct 48.9685	Nov 49.6241	Dec 50.3094	(38)
Heat transfer coeff	117.3045	116.9283	116.5596	114.8276	114.5035	112.9950	112.9950	112.7156	113.5760	114.5035	115.1591	115.8444	(39)
Average = Sum(39)m / 12 =												114.8260	
HLP	Jan 1.1416	Feb 1.1380	Mar 1.1344	Apr 1.1175	May 1.1144	Jun 1.0997	Jul 1.0997	Aug 1.0970	Sep 1.1054	Oct 1.1144	Nov 1.1208	Dec 1.1274	(40)
HLP (average)												1.1175	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7636												(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	30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615	(42b)
Hot water usage for other uses													

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Average daily hot water use (litres/day)	42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317 (42c)
	67.2742 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	73.3962	71.3826	69.1843	66.4484	64.0076	61.4711	60.9442	63.1380	65.3881	67.9929	70.7530	73.2932 (44)
Energy content (annual)	116.2416	101.6478	106.3337	90.9645	86.1665	75.5858	73.7067	78.1781	80.6300	92.2657	100.8006	114.7594 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1117.2806											
Distribution loss (46)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	98.8054	86.4007	90.3836	77.3198	73.2415	64.2480	62.6507	66.4514	68.5355	78.4259	85.6805	97.5455 (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	98.8054	86.4007	90.3836	77.3198	73.2415	64.2480	62.6507	66.4514	68.5355	78.4259	85.6805	97.5455 (64)
	Total per year (kWh/year) = Sum(64)m = 949.6885 (64)											
12Total per year (kWh/year)	950 (64)											
Electric shower(s)	56.5034	50.3450	54.9748	52.4618	53.4462	50.9825	52.6819	53.4462	52.4618	54.9748	53.9410	56.5034 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 642.7225 (64a)											
Heat gains from water heating, kWh/month	38.8272	34.1864	36.3396	32.4454	31.6719	28.8076	28.8332	29.9744	30.2493	33.3502	34.9054	38.5122 (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	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783	138.1783 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.8512	154.8353	139.8512	144.5129	139.8512	144.5129	139.8512	139.8512	144.5129	139.8512	144.5129	139.8512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.6984	263.4036	256.5865	242.0737	223.7539	206.5359	195.0332	192.3279	199.1450	213.6578	231.9776	249.1957 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178	36.8178 (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)	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427 (71)
Water heating gains (Table 5)	52.1871	50.8726	48.8436	45.0631	42.5698	40.0106	38.7542	40.2882	42.0129	44.8255	48.4797	51.7637 (72)
Total internal gains	517.1902	533.5650	509.7348	496.1032	470.6284	455.5129	438.0921	436.9208	450.1244	462.7880	489.4238	505.2641 (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				4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (76)			
South				1.1900	46.7521	0.6300	0.7000	0.7700	17.0028 (78)			
West				7.5500	19.6403	0.6300	0.7000	0.7700	45.3175 (80)			
South				1.2900	42.0754	0.6300	0.7000	1.0000	21.5426 (82)			
Solar gains	111.9538	211.2486	333.1880	469.7881	565.8460	575.8973	549.5835	477.9373	381.6437	246.3863	138.0901	93.0869 (83)
Total gains	629.1439	744.8136	842.9228	965.8913	1036.4744	1031.4102	987.6757	914.8581	831.7681	709.1743	627.5139	598.3511 (84)

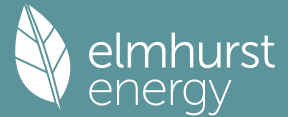
7. Mean internal temperature (heating season)

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	46.0335	46.1816	46.3278	47.0265	47.1596	47.7892	47.7892	47.9077	47.5447	47.1596	46.8912	46.6138
alpha	4.0689	4.0788	4.0885	4.1351	4.1440	4.1859	4.1859	4.1938	4.1696	4.1440	4.1261	4.1076
util living area	0.9933	0.9861	0.9700	0.9198	0.8163	0.6448	0.4888	0.5428	0.7818	0.9493	0.9871	0.9945 (86)
MIT	19.2736	19.5131	19.8691	20.3482	20.7151	20.9241	20.9812	20.9714	20.8260	20.3260	19.7242	19.2460 (87)
Th 2	19.9670	19.9699	19.9728	19.9865	19.9891	20.0011	20.0011	20.0033	19.9965	19.9891	19.9839	19.9785 (88)
util rest of house	0.9916	0.9826	0.9620	0.8983	0.7686	0.5630	0.3845	0.4356	0.7108	0.9312	0.9832	0.9931 (89)
MIT 2	18.3960	18.6356	18.9884	19.4591	19.7905	19.9623	19.9951	19.9933	19.8941	19.4491	18.8570	18.3770 (90)
Living area fraction	fLA = Living area / (4) = 0.3604 (91)											
MIT	18.7123	18.9518	19.3058	19.7795	20.1238	20.3089	20.3505	20.3458	20.2299	19.7651	19.1695	18.6901 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7123	18.9518	19.3058	19.7795	20.1238	20.3089	20.3505	20.3458	20.2299	19.7651	19.1695	18.6901 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9887	0.9779	0.9555	0.8932	0.7756	0.5894	0.4219	0.4737	0.7290	0.9263	0.9790	0.9907 (94)
Useful gains	622.0195	728.3629	805.3988	862.7487	803.8818	607.9413	416.6937	433.3868	606.3507	656.8908	614.3541	592.7585 (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	1690.6286	1643.0562	1492.6363	1249.2704	964.5496	645.0807	423.7890	444.7549	696.2143	1049.4407	1389.9150	1678.6024 (97)
Space heating kWh	795.0452	614.6739	511.3047	278.2956	119.5369	0.0000	0.0000	0.0000	0.0000	292.0571	558.4038	807.8679 (98a)
Space heating requirement - total per year (kWh/year)												3977.1851

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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	795.0452	614.6739	511.3047	278.2956	119.5369	0.0000	0.0000	0.0000	0.0000	292.0571	558.4038	807.8679 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3977.1851
Space heating per m2												(98c) / (4) = 38.7074 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1062.1528	836.1628	856.6387	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8299	0.8943	0.8638	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	881.5109	747.7996	739.9513	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1125.8656	1078.4534	998.2687	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	175.9354	246.0064	192.1881	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	43.9839	61.5016	48.0470	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												153.5325 (107)
Energy for space heating												38.7074 (99)
Energy for space cooling												1.4942 (108)
Total												40.2016 (109)
Fabric Energy Efficiency (TFEE)												40.2 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	255.0390 (5)

2. Ventilation rate

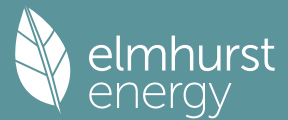
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.1568 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0100 (17)
Infiltration rate	0.4073 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3768 (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	0.4804	0.4710	0.4616	0.4145	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4239	0.4427 (22b)
Effective ac	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980 (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
Entrance door			1.9100	1.4000	2.6740		(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973		(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275		(27)
Opening 8			1.2900	1.2357	1.5941		(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008 (28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496 (28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692 (29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1200	0.7512	10.3700	64.9162 (29a)

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Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148	61.7800	5119.0908 (29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172 (29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812 (30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019 (30)
Total net area of external elements Aum(A, m2)			228.2300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.5339		(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946 (32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130 (32)
Internal Wall 1			72.1300			75.0000	5409.7500 (32c)
Internal Wall 2			59.5400			9.0000	535.8600 (32c)
Internal Floor 1			27.7900			18.0000	500.2200 (32d)
Internal Floor 2			30.3600			18.0000	546.4800 (32d)
Internal Ceiling 1			27.7900			9.0000	250.1100 (32e)
Internal Ceiling 2			30.3600			9.0000	273.2400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19439.7945 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 189.1951 (35)

List of Thermal Bridges							
K1 Element	Length	Psi-value	Total				
E2 Other lintels (including other steel lintels)	10.4400	0.0500	0.5220				
E3 Sill	9.5300	0.0200	0.1906				
E4 Jamb	24.9000	0.0150	0.3735				
E5 Ground floor (normal)	14.9500	0.0600	0.8970				
E6 Intermediate floor within a dwelling	41.1800	0.0010	0.0412				
E16 Corner (normal)	14.4000	0.0410	0.5904				
E18 Party wall between dwellings	4.2000	0.2400	1.0080				
R1 Head of roof window	1.6500	0.0610	0.1006				
R2 Sill of roof window	1.6500	0.0600	0.0990				
R3 Jamb of roof window	4.6800	0.0560	0.2621				
E5 Ground floor (normal)	12.7700	0.0600	0.7662				
E16 Corner (normal)	4.2000	0.1800	0.7560				
E10 Eaves (insulation at ceiling level)	8.4700	0.0590	0.4997				
E12 Gable (insulation at ceiling level)	7.1700	0.0430	0.3083				
E11 Eaves (insulation at rafter level)	9.9000	0.0180	0.1782				
E13 Gable (insulation at rafter level)	2.8800	0.0420	0.1210				
P1 Party wall - Ground floor	6.9400	0.0430	0.2984				
E18 Party wall between dwellings	10.0000	0.0430	0.4300				
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000				
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.0400	0.2868				
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0760	-0.1824				
R6 Flat ceiling	9.3000	0.1200	1.1160				
R10 All other roof or room-in-roof junctions	3.3000	0.3200	1.0560				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7186 (36)
Point Thermal bridges							0.0000 (36a)
Total fabric heat loss							(33) + (36) + (36a) = 63.2526 (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	51.7934	51.4162	51.0466	49.3103	48.9855	47.4732	47.4732	47.1932	48.0557	48.9855	49.6426	50.3297 (38)	
Average = Sum(39)m / 12 =	115.0459	114.6688	114.2992	112.5629	112.2380	110.7258	110.7258	110.4457	111.3083	112.2380	112.8952	113.5822 (39)	
												112.5613	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1197	1.1160	1.1124	1.0955	1.0923	1.0776	1.0776	1.0749	1.0833	1.0923	1.0987	1.1054 (40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

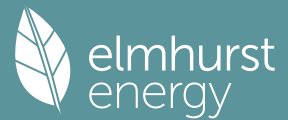
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7636 (42)
Hot water usage for mixer showers													
Hot water usage for baths													
Hot water usage for other uses													
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	152.7714	149.5649	145.6284	139.5667	134.6716	129.3980	127.3154	131.2343	135.3753	140.9189	147.0762	152.3642 (44)	
Energy content (annual)	241.9525	212.9784	223.8254	191.0599	181.2938	159.1099	153.9769	162.4955	166.9313	191.2256	209.5370	238.5656 (45)	
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	36.2929	31.9468	33.5738	28.6590	27.1941	23.8665	23.0965	24.3743	25.0397	28.6838	31.4306	35.7848 (46)	
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7560 (55)
Total storage loss													
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)	
Primary loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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													
WWHRS	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (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	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (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	117.8079	104.5587	111.7807	99.6810	97.6389	89.0577	88.5561	91.3885	91.6583	100.9412	105.8247	116.6818 (65)	

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.1984	29.4865	23.9800	18.1544	13.5706	11.4569	12.3796	16.0915	21.5979	27.4235	32.0073	34.1210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.1021	393.1397	382.9649	361.3041	333.9611	308.2625	291.0943	287.0566	297.2314	318.8923	346.2353	371.9339	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	(71)
Water heating gains (Table 5)	158.3440	155.5933	150.2428	138.4458	131.2351	123.6912	119.0270	122.8340	127.3031	135.6737	146.9787	156.8303	(72)
Total internal gains	693.2607	690.8358	669.8041	630.5206	591.3831	553.0269	532.1171	535.5983	555.7487	594.6058	637.8376	675.5015	(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		
West					4.7500	19.6403	0.6300	0.7000	0.7700	28.5110 (80)		
East					4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (76)		
South					1.1900	46.7521	0.6300	0.7000	0.7700	17.0028 (78)		
West					2.8000	19.6403	0.6300	0.7000	0.7700	16.8065 (80)		
South					1.2900	42.0754	0.6300	0.7000	1.0000	21.5426 (82)		
Solar gains	111.9538	211.2486	333.1880	469.7881	565.8460	575.8973	549.5835	477.9373	381.6437	246.3863	138.0901	93.0869 (83)
Total gains	805.2145	902.0843	1002.9921	1100.3087	1157.2291	1128.9242	1081.7007	1013.5357	937.3924	840.9921	775.9277	768.5885 (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	46.9373	47.0916	47.2439	47.9727	48.1115	48.7686	48.7686	48.8923	48.5134	48.1115	47.8315	47.5421	
Feb	4.1292	4.1394	4.1496	4.1982	4.2074	4.2512	4.2512	4.2595	4.2342	4.2074	4.1888	4.1695	
util living area	0.9838	0.9729	0.9469	0.8829	0.7642	0.5924	0.4419	0.4877	0.7210	0.9140	0.9728	0.9864	(86)
MIT	19.8239	19.9799	20.2342	20.5434	20.7700	20.8880	20.9183	20.9139	20.8364	20.5354	20.1281	19.8005	(87)
Th 2	19.9848	19.9878	19.9907	20.0045	20.0071	20.0191	20.0191	20.0214	20.0145	20.0071	20.0019	19.9964	(88)
util rest of house	0.9799	0.9665	0.9341	0.8554	0.7123	0.5139	0.3474	0.3900	0.6467	0.8874	0.9653	0.9831	(89)
MIT 2	18.6179	18.8170	19.1367	19.5215	19.7767	19.9008	19.9223	19.9224	19.8551	19.5231	19.0174	18.5972	(90)
Living area fraction									fLA = Living area / (4) =			0.3604	(91)
MIT	19.0525	19.2361	19.5322	19.8898	20.1347	20.2566	20.2812	20.2797	20.2088	19.8879	19.4177	19.0309	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0525	19.2361	19.5322	19.8898	20.1347	20.2566	20.2812	20.2797	20.2088	19.8879	19.4177	19.0309	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9753	0.9606	0.9272	0.8518	0.7195	0.5337	0.3731	0.4165	0.6625	0.8837	0.9597	0.9790	(94)
Useful gains	785.3076	866.5086	929.9870	937.2115	832.6062	602.4622	403.5747	422.1108	621.0273	743.1785	744.6329	752.4531	(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	1697.2149	1643.9027	1489.5691	1237.0379	946.6947	626.3275	407.6064	428.4999	679.9554	1042.4546	1390.6048	1684.5235	(97)
Space heating kWh	678.4590	522.4088	416.3290	215.8750	84.8818	0.0000	0.0000	0.0000	0.0000	222.6615	465.0997	693.4603	(98a)
Space heating requirement - total per year (kWh/year)												3299.1753	
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	678.4590	522.4088	416.3290	215.8750	84.8818	0.0000	0.0000	0.0000	0.0000	222.6615	465.0997	693.4603	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3299.1753	
Space heating per m ²										(98c) / (4) =		32.1088	(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 %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	678.4590	522.4088	416.3290	215.8750	84.8818	0.0000	0.0000	0.0000	0.0000	222.6615	465.0997	693.4603	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	399.0935	307.2993	244.8994	126.9853	49.9305	0.0000	0.0000	0.0000	0.0000	130.9773	273.5881	407.9179	(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	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640	(64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
(217)m													(217)

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Fuel for water heating, kWh/month	169.7946	150.0927	159.1317	138.9717	134.1131	120.1776	118.0443	123.0552	124.7784	139.9553	149.8406	167.8023	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.7115	-42.5736	-71.7903	-90.4981	-102.4650	-94.5489	-92.7608	-83.5677	-67.6657	-51.3036	-29.8613	-21.3840	(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	-5.1540	-13.2038	-33.4193	-63.4682	-97.6390	-105.9031	-103.4959	-81.5661	-52.5185	-22.8866	-7.6194	-3.8434	(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												1940.6913	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1695.7576	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												234.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1364.8479	(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												2506.1184	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1940.6913	16.4900	320.0200 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1695.7576	16.4900	279.6304 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	234.5173	16.4900	38.6719 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-774.1305	16.4900	-127.6541
PV Unit electricity exported	-590.7174	5.5900	-33.0211
Total			-160.6752 (252)
Total energy cost			477.6471 (255)

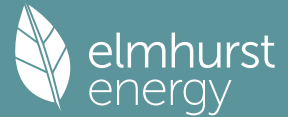
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		1.1638 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	81.1346
SAP rating (Section 12)		81 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1940.6913	0.1556	302.0548 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1695.7576	0.1410	239.1554 (264)
Space and water heating			541.2102 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	234.5173	0.1443	33.8481 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-774.1305	0.1326	-102.6823
PV Unit electricity exported	-590.7174	0.1202	-70.9866
Total			-173.6689 (269)
Total CO2, kg/year			401.3894 (272)
CO2 emissions per m2			3.9100 (273)
EI value			96.3596
EI rating			96 (274)
EI band			A

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	27.7900 (1a)	x 2.1000 (2a)	= 58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x 2.6400 (2b)	= 117.7440 (1b) - (3b)
First floor	30.3600 (1c)	x 2.6000 (2c)	= 78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 255.0390 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) = 0.1568 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0100 (17)
Infiltration rate		0.4073 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3768 (21)
Wind speed	Jan 4.3000 Feb 4.1000 Mar 4.1000 Apr 3.8000 May 3.9000 Jun 3.4000 Jul 3.4000 Aug 3.3000 Sep 3.4000 Oct 3.8000 Nov 3.7000 Dec 4.0000	(22)
Wind factor	1.0750 1.0250 1.0250 0.9500 0.9750 0.8500 0.8500 0.8250 0.8500 0.9500 0.9250 1.0000	(22a)
Adj infilt rate	0.4050 0.3862 0.3862 0.3579 0.3674 0.3203 0.3203 0.3109 0.3203 0.3579 0.3485 0.3768	(22b)
Effective ac	0.5820 0.5746 0.5746 0.5641 0.5675 0.5513 0.5513 0.5483 0.5513 0.5641 0.5607 0.5710	(25)

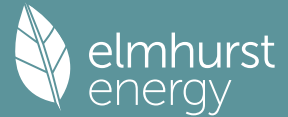
3. Heat losses and heat loss parameter

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
Entrance door			1.9100	1.4000	2.6740		(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973		(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275		(27)
Opening 8			1.2900	1.2357	1.5941		(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008 (28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496 (28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692 (29a)
Basement cavity wall	8.2400		6.2600	0.1200	0.7512	10.3700	64.9162 (29a)
Main cavity wall	96.2100	1.9800	82.8600	0.1800	14.9148	61.7800	5119.0908 (29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172 (29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812 (30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019 (30)
Total net area of external elements Aum(A, m ²)			228.2300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.5339		(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946 (32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130 (32)
Internal Wall 1			72.1300			75.0000	5409.7500 (32c)
Internal Wall 2			59.5400			9.0000	535.8600 (32c)
Internal Floor 1			27.7900			18.0000	500.2200 (32d)
Internal Floor 2			30.3600			18.0000	546.4800 (32d)
Internal Ceiling 1			27.7900			9.0000	250.1100 (32e)
Internal Ceiling 2			30.3600			9.0000	273.2400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				19439.7945 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							189.1951 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4400	0.0500	0.5220
E3 Sill	9.5300	0.0200	0.1906
E4 Jamb	24.9000	0.0150	0.3735
E5 Ground floor (normal)	14.9500	0.0600	0.8970
E6 Intermediate floor within a dwelling	41.1800	0.0010	0.0412
E16 Corner (normal)	14.4000	0.0410	0.5904
E18 Party wall between dwellings	4.2000	0.2400	1.0080
R1 Head of roof window	1.6500	0.0610	0.1006
R2 Sill of roof window	1.6500	0.0600	0.0990
R3 Jamb of roof window	4.6800	0.0560	0.2621
E5 Ground floor (normal)	12.7700	0.0600	0.7662
E16 Corner (normal)	4.2000	0.1800	0.7560
E10 Eaves (insulation at ceiling level)	8.4700	0.0590	0.4997
E12 Gable (insulation at ceiling level)	7.1700	0.0430	0.3083
E11 Eaves (insulation at rafter level)	9.9000	0.0180	0.1782
E13 Gable (insulation at rafter level)	2.8800	0.0420	0.1210
P1 Party wall - Ground floor	6.9400	0.0430	0.2984
E18 Party wall between dwellings	10.0000	0.0430	0.4300
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.0400	0.2868
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0760	-0.1824
R6 Flat ceiling	9.3000	0.1200	1.1160
R10 All other roof or room-in-roof junctions	3.3000	0.3200	1.0560
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.7186 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 63.2526 (37)

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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	48.9855	48.3582	48.3582	47.4732	47.7607	46.3979	46.3979	46.1477	46.3979	47.4732	47.1932	48.0557	(38)
Heat transfer coeff	112.2380	111.6107	111.6107	110.7258	111.0133	109.6504	109.6504	109.4002	109.6504	110.7258	110.4457	111.3083	(39)
Average = Sum(39)m / 12 =												110.6692	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0923	1.0862	1.0862	1.0776	1.0804	1.0672	1.0672	1.0647	1.0672	1.0776	1.0749	1.0833	(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													2.7636 (42)
Hot water usage for mixer showers													
	79.3752	78.1823	76.4441	73.1183	70.6640	67.9269	66.3712	68.0963	69.9873	72.9260	76.3232	79.0711	(42a)
Hot water usage for baths													
	30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615	(42b)
Hot water usage for other uses													
	42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317	(42c)
Average daily hot water use (litres/day)													140.4554 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	152.7714	149.5649	145.6284	139.5667	134.6716	129.3980	127.3154	131.2343	135.3753	140.9189	147.0762	152.3642	(44)
Energy conte	241.9525	212.9784	223.8254	191.0599	181.2938	159.1099	153.9769	162.4955	166.9313	191.2256	209.5370	238.5656	(45)
Energy content (annual)										Total = Sum(45)m =		2332.9519	
Distribution loss (46)m = 0.15 x (45)m													
	36.2929	31.9468	33.5738	28.6590	27.1941	23.8665	23.0965	24.3743	25.0397	28.6838	31.4306	35.7848	(46)
Water storage loss:													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.4000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7560 (55)
Total storage loss													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(56)
If cylinder contains dedicated solar storage													
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360	(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													
	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640	(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													
	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640	(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													
	117.8079	104.5587	111.7807	99.6810	97.6389	89.0577	88.5561	91.3885	91.6583	100.9412	105.8247	116.6818	(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	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.1984	29.4865	23.9800	18.1544	13.5706	11.4569	12.3796	16.0915	21.5979	27.4235	32.0073	34.1210	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	389.1021	393.1397	382.9649	361.3041	333.9611	308.2625	291.0943	287.0566	297.2314	318.8923	346.2353	371.9339	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	(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)													
	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	(71)
Water heating gains (Table 5)													
	158.3440	155.5933	150.2428	138.4458	131.2351	123.6912	119.0270	122.8340	127.3031	135.6737	146.9787	156.8303	(72)
Total internal gains													
	693.2607	690.8358	669.8041	630.5206	591.3831	553.0269	532.1171	535.5983	555.7487	594.6058	637.8376	675.5015	(73)

6. Solar gains

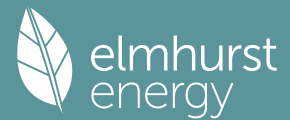
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
West	4.7500	23.8018	0.6300	0.7000	0.7700	34.5521 (80)
East	4.6800	23.8018	0.6300	0.7000	0.7700	34.0429 (76)
South	1.9000	54.2217	0.6300	0.7000	0.7700	19.7193 (78)
West	2.8000	23.8018	0.6300	0.7000	0.7700	20.3676 (80)
South	1.2900	50.2348	0.6300	0.7000	1.0000	25.7203 (82)

Solar gains	134.4022	221.7096	347.1501	496.7497	582.8245	627.4644	592.8800	528.6731	423.8236	277.5621	163.3387	112.3758	(83)
Total gains	827.6629	912.5454	1016.9542	1127.2703	1174.2076	1180.4912	1124.9971	1064.2715	979.5723	872.1680	801.1763	787.8773	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	48.1115	48.3819	48.3819	48.7686	48.6423	49.2469	49.2469	49.3595	49.2469	48.7686	48.8923	48.5134	

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alpha	4.2074	4.2255	4.2255	4.2512	4.2428	4.2831	4.2831	4.2906	4.2831	4.2512	4.2595	4.2342
util living area	0.9785	0.9657	0.9307	0.8428	0.6890	0.4717	0.3199	0.3470	0.6260	0.8770	0.9614	0.9817 (86)
MIT	19.9699	20.1147	20.3652	20.6526	20.8385	20.9147	20.9260	20.9253	20.8837	20.6446	20.2716	19.9471 (87)
Th 2	20.0071	20.0121	20.0121	20.0191	20.0169	20.0277	20.0277	20.0297	20.0277	20.0191	20.0214	20.0145 (88)
util rest of house	0.9732	0.9575	0.9140	0.8071	0.6260	0.3883	0.2266	0.2493	0.5408	0.8399	0.9504	0.9772 (89)
MIT 2	18.8201	19.0056	19.3152	19.6597	19.8539	19.9286	19.9347	19.9367	19.9078	19.6595	19.2123	18.7974 (90)
Living area fraction	19.2344	19.4053	19.6936	20.0175	20.2087	20.2840	20.2919	20.2930	20.2595	20.0146	19.5940	19.2117 (92)
MIT	19.2344	19.4053	19.6936	20.0175	20.2087	20.2840	20.2919	20.2930	20.2595	20.0146	19.5940	19.2117 (93)
Temperature adjustment												0.0000
adjusted MIT	19.2344	19.4053	19.6936	20.0175	20.2087	20.2840	20.2919	20.2930	20.2595	20.0146	19.5940	19.2117 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9680	0.9512	0.9077	0.8070	0.6390	0.4107	0.2521	0.2760	0.5621	0.8397	0.9445	0.9724 (94)
Useful gains	801.1422	868.0493	923.0890	909.7517	750.3253	484.8650	283.6214	293.7481	550.5916	732.3511	756.7084	766.1425 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	1586.4214	1529.6581	1372.1021	1120.2719	811.3673	491.6684	284.2078	294.6104	576.7064	942.7805	1280.5107	1570.7501 (97)
Space heating kWh	584.2477	444.6011	334.0657	151.5746	45.4153	0.0000	0.0000	0.0000	0.0000	156.5595	377.1376	598.6281 (98a)
Space heating requirement - total per year (kWh/year)												2692.2296
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	584.2477	444.6011	334.0657	151.5746	45.4153	0.0000	0.0000	0.0000	0.0000	156.5595	377.1376	598.6281 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2692.2296
Space heating per m2										(98c) / (4) =		26.2017 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	584.2477	444.6011	334.0657	151.5746	45.4153	0.0000	0.0000	0.0000	0.0000	156.5595	377.1376	598.6281 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	343.6751	261.5301	196.5093	89.1615	26.7149	0.0000	0.0000	0.0000	0.0000	92.0938	221.8457	352.1342 (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	288.6509	255.1576	270.5238	236.2519	227.9922	204.3019	200.6753	209.1939	212.1233	237.9240	254.7290	285.2640 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	169.7946	150.0927	159.1317	138.9717	134.1131	120.1776	118.0443	123.0552	124.7784	139.9553	149.8406	167.8023 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-30.5255	-44.5367	-73.9280	-93.0651	-103.1352	-100.0248	-97.5902	-89.7057	-73.4170	-56.2591	-34.7220	-25.5771 (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	-7.0860	-14.8605	-37.1312	-71.4582	-104.6651	-119.9175	-115.7294	-94.7052	-61.6781	-28.5068	-10.2759	-5.3355 (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												1583.6645 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1695.7576 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												234.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1493.8358 (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												2020.1036 (238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1583.6645	26.0600	412.7030 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1695.7576	26.0600	441.9144 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	234.5173	26.0600	61.1152 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-822.4865	26.0600	-214.3400
PV Unit electricity exported	-671.3493	5.8100	-39.0054
Total			-253.3454 (252)
Total energy cost			662.3872 (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	1583.6645	0.1564	247.6276 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1695.7576	0.1410	239.1554 (264)
Space and water heating			486.7830 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	234.5173	0.1443	33.8481 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-822.4865	0.1328	-109.2374
PV Unit electricity exported	-671.3493	0.1204	-80.8174
Total			-190.0548 (269)
Total CO2, kg/year			330.5763 (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	1583.6645	1.5789	2500.4214 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1695.7576	1.5215	2580.0788 (278)
Space and water heating			5080.5002 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	234.5173	1.5338	359.7105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-822.4865	1.4908	-1226.1292
PV Unit electricity exported	-671.3493	0.4415	-296.4165
Total			-1522.5457 (283)
Total Primary energy kWh/year			3917.6649 (286)

SAP 10 EPC IMPROVEMENTS

Proposed

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 91	-46 kg (14.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£91	0.45 kg/m²	B 83 A 97
Total Savings	£91	0.45 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 552 TEST (30 Aug 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £916	Potential £818	Saving £97
Electricity			
Space heating	£413	£434	-£22
Water heating	£442	£323	£119
Lighting	£61	£61	£0
Generated (PV)	-£253	-£247	-£7
Total cost of fuels	£663	£571	£90
Total cost of uses	£663	£571	£90
Delivered energy	20 kWh/m²	16 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	38 kWh/m²	33 kWh/m²	5 kWh/m²

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Basement floor	27.7900 (1a)	x	2.1000 (2a)	=	58.3590 (1a) - (3a)	
Ground floor	44.6000 (1b)	x	2.6400 (2b)	=	117.7440 (1b) - (3b)	
First floor	30.3600 (1c)	x	2.6000 (2c)	=	78.9360 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.7500					
Dwelling volume				(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	255.0390 (5)	

2. Ventilation rate

		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1568 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0100		
Infiltration rate	0.4073 (18)		
Number of sides sheltered	1 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3768 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4804	0.4710	0.4616	0.4145	0.4050	0.3579	0.3579	0.3485	0.3768	0.4050	0.4239	0.4427	(22b)
	0.6154	0.6109	0.6065	0.5859	0.5820	0.5641	0.5641	0.5607	0.5710	0.5820	0.5898	0.5980	(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	
Entrance door			1.9100	1.4000	2.6740			(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973			(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275			(27)
Opening 8			1.2900	1.2357	1.5941			(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008	(28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496	(28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692	(29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1200	0.7512	10.3700	64.9162	(29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148	61.7800	5119.0908	(29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172	(29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812	(30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019	(30)
Total net area of external elements Aum(A, m ²)			228.2300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.5339				(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946	(32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130	(32)
Internal Wall 1			72.1300			75.0000	5409.7500	(32c)
Internal Wall 2			59.5400			9.0000	535.8600	(32c)
Internal Floor 1			27.7900			18.0000	500.2200	(32d)
Internal Floor 2			30.3600			18.0000	546.4800	(32d)
Internal Ceiling 1			27.7900			9.0000	250.1100	(32e)
Internal Ceiling 2			30.3600			9.0000	273.2400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19439.7945 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 189.1951 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	10.4400	0.0500	0.5220
E3 Sill	9.5300	0.0200	0.1906
E4 Jamb	24.9000	0.0150	0.3735
E5 Ground floor (normal)	14.9500	0.0600	0.8970
E6 Intermediate floor within a dwelling	41.1800	0.0010	0.0412
E16 Corner (normal)	14.4000	0.0410	0.5904
E18 Party wall between dwellings	4.2000	0.2400	1.0080
R1 Head of roof window	1.6500	0.0610	0.1006
R2 Sill of roof window	1.6500	0.0600	0.0990
R3 Jamb of roof window	4.6800	0.0560	0.2621
E5 Ground floor (normal)	12.7700	0.0600	0.7662
E16 Corner (normal)	4.2000	0.1800	0.7560
E10 Eaves (insulation at ceiling level)	8.4700	0.0590	0.4997
E12 Gable (insulation at ceiling level)	7.1700	0.0430	0.3083
E11 Eaves (insulation at rafter level)	9.9000	0.0180	0.1782

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E13 Gable (insulation at rafter level)						2.8800	0.0420	0.1210				
P1 Party wall - Ground floor						6.9400	0.0430	0.2984				
E18 Party wall between dwellings						10.0000	0.0430	0.4300				
P2 Party wall - Intermediate floor within a dwelling						14.3400	0.0000	0.0000				
P4 Party wall - Roof (insulation at ceiling level)						7.1700	0.0400	0.2868				
E17 Corner (inverted - internal area greater than external area)						2.4000	-0.0760	-0.1824				
R6 Flat ceiling						9.3000	0.1200	1.1160				
R10 All other roof or room-in-roof junctions						3.3000	0.3200	1.0560				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											9.7186	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	63.2526 (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	51.7934	51.4162	51.0466	49.3103	48.9855	47.4732	47.4732	47.1932	48.0557	48.9855	49.6426	50.3297 (38)
Average = Sum(39)m / 12 =	115.0459	114.6688	114.2992	112.5629	112.2380	110.7258	110.7258	110.4457	111.3083	112.2380	112.8952	113.5822 (39)
												112.5613
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1197	1.1160	1.1124	1.0955	1.0923	1.0776	1.0776	1.0749	1.0833	1.0923	1.0987	1.1054 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

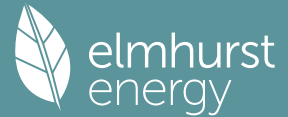
4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7636 (42)
Hot water usage for mixer showers												
	79.3752	78.1823	76.4441	73.1183	70.6640	67.9269	66.3712	68.0963	69.9873	72.9260	76.3232	79.0711 (42a)
Hot water usage for baths												
	30.4645	30.0120	29.3749	28.2002	27.3205	26.3451	25.8183	26.4510	27.1398	28.1835	29.3825	30.3615 (42b)
Hot water usage for other uses												
	42.9317	41.3705	39.8094	38.2482	36.6871	35.1259	35.1259	36.6871	38.2482	39.8094	41.3705	42.9317 (42c)
Average daily hot water use (litres/day)												140.4554 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	152.7714	149.5649	145.6284	139.5667	134.6716	129.3980	127.3154	131.2343	135.3753	140.9189	147.0762	152.3642 (44)
Energy conte	241.9525	212.9784	223.8254	191.0599	181.2938	159.1099	153.9769	162.4955	166.9313	191.2256	209.5370	238.5656 (45)
Energy content (annual)										Total = Sum(45)m =		2332.9519
Distribution loss (46)m = 0.15 x (45)m												
	36.2929	31.9468	33.5738	28.6590	27.1941	23.8665	23.0965	24.3743	25.0397	28.6838	31.4306	35.7848 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage												
	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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												
	288.6509	255.1576	269.1281	229.4983	215.1979	191.6952	187.6484	197.0974	206.7204	236.5283	254.7290	285.2640 (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												629.3619 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												629.3619
Solar input	-0.0000	-16.1953	-58.7771	-81.1036	-106.3119	-97.9605	-97.1958	-84.8108	-58.2752	-28.7316	-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												
	288.6509	238.9623	210.3510	148.3946	108.8860	93.7347	90.4526	112.2866	148.4452	207.7967	254.7290	285.2640 (64)
Electric shower(s)												2187.9537 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	117.8079	104.5587	110.6641	94.2781	87.4035	78.9723	78.1345	81.7113	87.3359	99.8246	105.8247	116.6818 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	33.1984	29.4865	23.9800	18.1544	13.5706	11.4569	12.3796	16.0915	21.5979	27.4235	32.0073	34.1210 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	389.1021	393.1397	382.9649	361.3041	333.9611	308.2625	291.0943	287.0566	297.2314	318.8923	346.2353	371.9339 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450 (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)												
	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427 (71)
Water heating gains (Table 5)												
	158.3440	155.5933	148.7420	130.9418	117.4778	109.6837	105.0195	109.8270	121.2999	134.1729	146.9787	156.8303 (72)
Total internal gains												
	693.2607	690.8358	668.3033	623.0166	577.6258	539.0194	518.1097	522.5914	549.7455	593.1050	637.8376	675.5015 (73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W			
West	4.7500				19.6403	0.6300	0.7000	0.7700	28.5110 (80)			
East	4.6800				19.6403	0.6300	0.7000	0.7700	28.0909 (76)			
South	1.1900				46.7521	0.6300	0.7000	0.7700	17.0028 (78)			
West	2.8000				19.6403	0.6300	0.7000	0.7700	16.8065 (80)			
South	1.2900				42.0754	0.6300	0.7000	1.0000	21.5426 (82)			
Solar gains	111.9538	211.2486	333.1880	469.7881	565.8460	575.8973	549.5835	477.9373	381.6437	246.3863	138.0901	93.0869 (83)
Total gains	805.2145	902.0843	1001.4913	1092.8047	1143.4718	1114.9167	1067.6932	1000.5287	931.3892	839.4913	775.9277	768.5885 (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	46.9373	47.0916	47.2439	47.9727	48.1115	48.7686	48.7686	48.8923	48.5134	48.1115	47.8315	47.5421
alpha	4.1292	4.1394	4.1496	4.1982	4.2074	4.2512	4.2512	4.2595	4.2342	4.2074	4.1888	4.1695
util living area	0.9838	0.9729	0.9471	0.8850	0.7694	0.5984	0.4473	0.4934	0.7240	0.9145	0.9728	0.9864 (86)
MIT	19.8239	19.9799	20.2330	20.5391	20.7656	20.8865	20.9179	20.9133	20.8349	20.5344	20.1281	19.8005 (87)
Th 2	19.9848	19.9878	19.9907	20.0045	20.0071	20.0191	20.0191	20.0214	20.0145	20.0071	20.0019	19.9964 (88)
util rest of house	0.9799	0.9665	0.9344	0.8577	0.7179	0.5196	0.3518	0.3949	0.6499	0.8880	0.9653	0.9831 (89)
MIT 2	18.6179	18.8170	19.1353	19.5166	19.7725	19.8997	19.9221	19.9221	19.8539	19.5219	19.0174	18.5972 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.0525	19.2361	19.5309	19.8851	20.1304	20.2553	20.2810	20.2793	20.2074	19.8868	19.4177	19.0309 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.0525	19.2361	19.5309	19.8851	20.1304	20.2553	20.2810	20.2793	20.2074	19.8868	19.4177	19.0309 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9753	0.9606	0.9275	0.8540	0.7248	0.5394	0.3778	0.4215	0.6655	0.8842	0.9597	0.9790 (94)
Useful gains	785.3076	866.5086	928.8864	933.2532	828.8437	601.3623	403.3490	421.7677	619.8660	742.2692	744.6329	752.4531 (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	1697.2149	1643.9027	1489.4195	1236.5125	946.2142	626.1917	407.5769	428.4558	679.8093	1042.3334	1390.6048	1684.5235 (97)
Space heating kWh	678.4590	522.4088	417.0366	218.3467	87.3236	0.0000	0.0000	0.0000	0.0000	223.2478	465.0997	693.4603 (98a)
Space heating requirement - total per year (kWh/year)												3305.3827
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	678.4590	522.4088	417.0366	218.3467	87.3236	0.0000	0.0000	0.0000	0.0000	223.2478	465.0997	693.4603 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3305.3827
Space heating per m2												(98c) / (4) = 32.1692 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	678.4590	522.4088	417.0366	218.3467	87.3236	0.0000	0.0000	0.0000	0.0000	223.2478	465.0997	693.4603 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	399.0935	307.2993	245.3157	128.4392	51.3668	0.0000	0.0000	0.0000	0.0000	131.3222	273.5881	407.9179 (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	288.6509	238.9623	210.3510	148.3946	108.8860	93.7347	90.4526	112.2866	148.4452	207.7967	254.7290	285.2640 (64)
Efficiency of water heater	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	169.7946	140.5661	123.7359	87.2910	64.0506	55.1381	53.2074	66.0510	87.3207	122.2334	149.8406	167.8023 (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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-25.7294	-42.5474	-71.2334	-88.4815	-97.3795	-88.2334	-86.5227	-79.2653	-65.9419	-51.1153	-29.8929	-21.3976 (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)	-5.1361	-13.2300	-33.9762	-65.4849	-102.7246	-112.2186	-109.7339	-85.8685	-54.2424	-23.0749	-7.5878	-3.8299 (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)

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

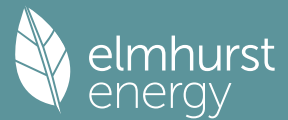
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
Basement floor	27.7900 (1a)	x	2.1000 (2a)	=	58.3590 (1a) - (3a)
Ground floor	44.6000 (1b)	x	2.6400 (2b)	=	117.7440 (1b) - (3b)
First floor	34.3600 (1c)	x	2.6000 (2c)	=	78.9360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	102.7500				(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	=	255.0390 (5)

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2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans												40.0000 / (5) = 0.1568 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0100 (17)
Infiltration rate												0.4073 (18)
Number of sides sheltered												1 (19)
												(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Shelter factor												(21) = (18) x (20) = 0.3768 (21)
Infiltration rate adjusted to include shelter factor												

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000	(22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000	(22a)
Effective ac	0.4050	0.3862	0.3862	0.3579	0.3674	0.3203	0.3203	0.3109	0.3203	0.3579	0.3485	0.3768	(22b)
	0.5820	0.5746	0.5746	0.5641	0.5675	0.5513	0.5513	0.5483	0.5513	0.5641	0.5607	0.5710	(25)

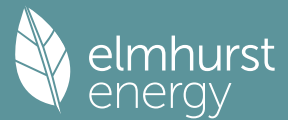
3. Heat losses and heat loss parameter

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	
Entrance door			1.9100	1.4000	2.6740			(26a)
Glazed door (Uw = 1.40)			4.7500	1.3258	6.2973			(27)
Windows (Uw = 1.20)			8.6700	1.1450	9.9275			(27)
Opening 8			1.2900	1.2357	1.5941			(27a)
Basement floor			27.7900	0.1200	3.3348	65.5200	1820.8008	(28)
Kitchen floor			14.2300	0.1200	1.7076	65.5200	932.3496	(28a)
Basement wall	23.1600		23.1600	0.2100	4.8636	10.3700	240.1692	(29a)
Basement cavity wall	8.2400	1.9800	6.2600	0.1200	0.7512	10.3700	64.9162	(29a)
Main cavity wall	96.2100	13.3500	82.8600	0.1800	14.9148	61.7800	5119.0908	(29a)
Kitchen adjoining wall	11.8800		11.8800	0.1700	2.0196	69.6900	827.9172	(29a)
External Roof 1	30.3600		30.3600	0.1100	3.3396	12.1700	369.4812	(30)
External Roof 2	16.3600	1.2900	15.0700	0.1400	2.1098	12.1700	183.4019	(30)
Total net area of external elements Aum(A, m2)			228.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.5339			(33)
Basement party wall			14.5800	0.0000	0.0000	10.3700	151.1946	(32)
Party Wall 2			35.8500	0.0000	0.0000	61.7800	2214.8130	(32)
Internal Wall 1			72.1300			75.0000	5409.7500	(32c)
Internal Wall 2			59.5400			9.0000	535.8600	(32c)
Internal Floor 1			27.7900			18.0000	500.2200	(32d)
Internal Floor 2			30.3600			18.0000	546.4800	(32d)
Internal Ceiling 1			27.7900			9.0000	250.1100	(32e)
Internal Ceiling 2			30.3600			9.0000	273.2400	(32e)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(28)...(30) + (32) + (32a)...(32e) = 19439.7945 (34)
List of Thermal Bridges								189.1951 (35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.4400	0.0500	0.5220	
E3 Sill	9.5300	0.0200	0.1906	
E4 Jamb	24.9000	0.0150	0.3735	
E5 Ground floor (normal)	14.9500	0.0600	0.8970	
E6 Intermediate floor within a dwelling	41.1800	0.0010	0.0412	
E16 Corner (normal)	14.4000	0.0410	0.5904	
E18 Party wall between dwellings	4.2000	0.2400	1.0080	
R1 Head of roof window	1.6500	0.0610	0.1006	
R2 Sill of roof window	1.6500	0.0600	0.0990	
R3 Jamb of roof window	4.6800	0.0560	0.2621	
E5 Ground floor (normal)	12.7700	0.0600	0.7662	
E16 Corner (normal)	4.2000	0.1800	0.7560	
E10 Eaves (insulation at ceiling level)	8.4700	0.0590	0.4997	
E12 Gable (insulation at ceiling level)	7.1700	0.0430	0.3083	
E11 Eaves (insulation at rafter level)	9.9000	0.0180	0.1782	
E13 Gable (insulation at rafter level)	2.8800	0.0420	0.1210	
P1 Party wall - Ground floor	6.9400	0.0430	0.2984	
E18 Party wall between dwellings	10.0000	0.0430	0.4300	
P2 Party wall - Intermediate floor within a dwelling	14.3400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	7.1700	0.0400	0.2868	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0760	-0.1824	
R6 Flat ceiling	9.3000	0.1200	1.1160	
R10 All other roof or room-in-roof junctions	3.3000	0.3200	1.0560	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.7186 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 63.2526 (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	48.9855	48.3582	48.3582	47.4732	47.7607	46.3979	46.3979	46.1477	46.3979	47.4732	47.1932	48.0557 (38)
Average = Sum(39)m / 12 =	112.2380	111.6107	111.6107	110.7258	111.0133	109.6504	109.6504	109.4002	109.6504	110.7258	110.4457	111.3083 (39)
												110.6692
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0923	1.0862	1.0862	1.0776	1.0804	1.0672	1.0672	1.0647	1.0672	1.0776	1.0749	1.0833 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7636 (42)
Hot water usage for mixer showers												79.0711 (42a)
Hot water usage for baths												30.3615 (42b)
Hot water usage for other uses												42.9317 (42c)
Average daily hot water use (litres/day)												140.4554 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	152.7714	149.5649	145.6284	139.5667	134.6716	129.3980	127.3154	131.2343	135.3753	140.9189	147.0762	152.3642 (44)
Energy content (annual)	241.9525	212.9784	223.8254	191.0599	181.2938	159.1099	153.9769	162.4955	166.9313	191.2256	209.5370	238.5656 (45)
Distribution loss (46)m = 0.15 x (45)m												35.7848 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss												
If cylinder contains dedicated solar storage												
Primary loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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												
WWHRS	288.6509	255.1576	269.1281	229.4983	215.1979	191.6952	187.6484	197.0974	206.7204	236.5283	254.7290	285.2640 (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)
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												710.2502 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												710.2502
Solar input	-0.7985	-19.6177	-63.5715	-88.3144	-111.3185	-109.1247	-107.0330	-97.2438	-69.1024	-38.7140	-5.4118	-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	287.8523	235.5400	205.5566	141.1839	103.8794	82.5705	80.6154	99.8537	137.6180	197.8143	249.3173	285.2640 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	117.8079	104.5587	110.6641	94.2781	87.4035	78.9723	78.1345	81.7113	87.3359	99.8246	105.8247	116.6818 (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	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140	165.8140 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	33.1984	29.4865	23.9800	18.1544	13.5706	11.4569	12.3796	16.0915	21.5979	27.4235	32.0073	34.1210 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	389.1021	393.1397	382.9649	361.3041	333.9611	308.2625	291.0943	287.0566	297.2314	318.8923	346.2353	371.9339 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450	54.3450 (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)												
	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427	-110.5427 (71)
Water heating gains (Table 5)												
	158.3440	155.5933	148.7420	130.9418	117.4778	109.6837	105.0195	109.8270	121.2999	134.1729	146.9787	156.8303 (72)
Total internal gains	693.2607	690.8358	668.3033	623.0166	577.6258	539.0194	518.1097	522.5914	549.7455	593.1050	637.8376	675.5015 (73)

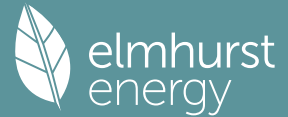
6. Solar gains

[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
West					4.7500	23.8018	0.6300	0.7000		0.7700		34.5521 (80)
East					4.6800	23.8018	0.6300	0.7000		0.7700		34.0429 (76)
South					1.1900	54.2217	0.6300	0.7000		0.7700		19.7193 (78)
West					2.8000	23.8018	0.6300	0.7000		0.7700		20.3676 (80)
South					1.2900	50.2348	0.6300	0.7000		1.0000		25.7203 (82)
Solar gains	134.4022	221.7096	347.1501	496.7497	582.8245	627.4644	592.8800	528.6731	423.8236	277.5621	163.3387	112.3758 (83)
Total gains	827.6629	912.5454	1015.4534	1119.7663	1160.4503	1166.4838	1110.9897	1051.2645	973.5691	870.6672	801.1763	787.8773 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	48.1115	48.3819	48.3819	48.7686	48.6423	49.2469	49.2469	49.3595	49.2469	48.7686	48.8923	48.5134

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alpha	4.2074	4.2255	4.2255	4.2512	4.2428	4.2831	4.2831	4.2906	4.2831	4.2512	4.2595	4.2342
util living area	0.9785	0.9657	0.9310	0.8453	0.6947	0.4769	0.3239	0.3512	0.6290	0.8775	0.9614	0.9817 (86)
MIT	19.9699	20.1147	20.3642	20.6490	20.8356	20.9141	20.9259	20.9252	20.8829	20.6438	20.2716	19.9471 (87)
Th 2	20.0071	20.0121	20.0121	20.0191	20.0169	20.0277	20.0277	20.0297	20.0277	20.0191	20.0214	20.0145 (88)
util rest of house	0.9732	0.9575	0.9144	0.8098	0.6318	0.3928	0.2294	0.2523	0.5436	0.8405	0.9504	0.9772 (89)
MIT 2	18.8201	19.0056	19.3139	19.6559	19.8515	19.9283	19.9347	19.9366	19.9073	19.6586	19.2123	18.7974 (90)
Living area fraction	19.2344	19.4053	19.6924	20.0138	20.2062	20.2836	20.2919	20.2929	20.2589	20.0137	19.5940	0.3604 (91)
MIT	19.2344	19.4053	19.6924	20.0138	20.2062	20.2836	20.2919	20.2929	20.2589	20.0137	19.5940	19.2117 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2344	19.4053	19.6924	20.0138	20.2062	20.2836	20.2919	20.2929	20.2589	20.0137	19.5940	19.2117 (93)

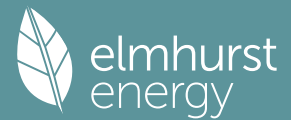
8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9680	0.9512	0.9080	0.8096	0.6446	0.4154	0.2553	0.2794	0.5649	0.8403	0.9445	0.9724 (94)
Ext temp.	801.1422	868.0493	922.0808	906.5656	748.0188	484.5253	283.5865	293.6985	550.0174	731.6097	756.7084	766.1425 (95)
Heat loss rate W	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Space heating kWh	1586.4214	1529.6581	1371.9678	1119.8596	811.0804	491.6259	284.2026	294.6032	576.6355	942.6836	1280.5107	1570.7501 (97)
Space heating requirement - total per year (kWh/year)	584.2477	444.6011	334.7159	153.5716	46.9178	0.0000	0.0000	0.0000	0.0000	157.0390	377.1376	598.6281 (98a)
Solar heating kWh												2696.8589
Solar heating contribution - total per year (kWh/year)	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (98b)
Space heating kWh	584.2477	444.6011	334.7159	153.5716	46.9178	0.0000	0.0000	0.0000	0.0000	157.0390	377.1376	598.6281 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2696.8589
Space heating per m2										(98c) / (4) =		26.2468 (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 %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	584.2477	444.6011	334.7159	153.5716	46.9178	0.0000	0.0000	0.0000	0.0000	157.0390	377.1376	598.6281 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	343.6751	261.5301	196.8917	90.3363	27.5987	0.0000	0.0000	0.0000	0.0000	92.3759	221.8457	352.1342 (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	287.8523	235.5400	205.5566	141.1839	103.8794	82.5705	80.6154	99.8537	137.6180	197.8143	249.3173	285.2640 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	169.3249	138.5529	120.9156	83.0493	61.1055	48.5709	47.4208	58.7374	80.9518	116.3613	146.6572	167.8023 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	29.0583	23.3117	20.9896	15.3779	11.8783	9.7047	10.8358	14.0848	18.2947	24.0036	27.1121	29.8659 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-30.5496	-44.4870	-73.2045	-90.4106	-97.1245	-92.1573	-89.9940	-84.0445	-70.9974	-55.8704	-34.7454	-25.5969 (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	-7.0619	-14.9102	-37.8547	-74.1126	-110.6758	-127.7850	-123.3256	-100.3664	-64.0976	-28.8955	-10.2525	-5.3157 (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												1586.3876 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												1239.4502 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												234.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1493.8358 (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												1646.5193 (238)

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10a. Fuel costs - using BEDF prices (552)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1586.3876	26.0600	413.4126 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1239.4502	26.0600	323.0007 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	26.0600	20.8480 (249)
Energy for lighting	234.5173	26.0600	61.1152 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.1822	26.0600	-205.6609
PV Unit electricity exported	-704.6536	5.8100	-40.9404
Total			-246.6013 (252)
Total energy cost			571.7753 (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	1586.3876	0.1563	248.0091 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1239.4502	0.1461	181.0796 (264)
Space and water heating			429.0887 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	234.5173	0.1443	33.8481 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.1822	0.1333	-105.1871
PV Unit electricity exported	-704.6536	0.1199	-84.5015
Total			-189.6885 (269)
Total CO2, kg/year			284.3452 (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	1586.3876	1.5788	2504.5570 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1239.4502	1.5404	1909.3020 (278)
Space and water heating			4413.8590 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	234.5173	1.5338	359.7105 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.1822	1.4925	-1177.8856
PV Unit electricity exported	-704.6536	0.4398	-309.8987
Total			-1487.7843 (283)
Total Primary energy kWh/year			3406.8092 (286)