

Full SAP Calculation Printout



Property Reference	Proposed House			Issued on Date	18/11/2024
Assessment Reference	Revised Design	Prop Type Ref			
Property	Warren Creek, Caversham, Reading, Berkshire, RG4 7TQ				
SAP Rating	98 A	DER	0.53	TER	8.38
Environmental	99 A	% DER < TER			93.68
CO ₂ Emissions (t/year)	-0.02	DFEE	41.56	TFEE	41.90
Compliance Check	See BREL	% DFEE < TFEE			0.82
% DPER < TPER	82.66	DPER	7.68	TPER	44.32
Assessor Details	Mrs. Chitra Deshpande			Assessor ID	CF77-0001
Client	3863, Mr R Arnold				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 642.0100 (5)

2. Ventilation rate

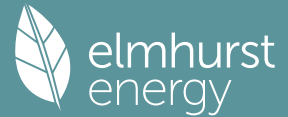
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	1 * 10 = 10.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	7 * 10 = 70.0000 (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) =	80.0000 / (5) = 0.1246 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3246 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3246 (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	0.4139	0.4058	0.3976	0.3571	0.3490	0.3084	0.3084	0.3003	0.3246	0.3490	0.3652	0.3814 (22b)
Effective ac	0.5856	0.5823	0.5791	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727 (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
Windows (Uw = 0.80)			26.4700	0.7752	20.5194		(27)
Glazed Doors (Uw = 0.80)			27.9900	0.7752	21.6977		(27)
Solid Door			2.1600	1.0000	2.1600		(26)
Heatloss Floor 1			117.8000	0.1300	15.3140		(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600 (29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400 (30)
Total net area of external elements Aum(A, m ²)			487.5490				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.9903		(33)
Internal Wall 1			510.0000			9.0000	4590.0000 (32c)
Internal Ceiling 1			156.1900			9.0000	1405.7100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34381.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.9296 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				43.5800	0.3060	13.3355	
E3 Sill				27.6000	0.0160	0.4416	
E4 Jamb				77.6900	0.0170	1.3207	
E5 Ground floor (normal)				55.4500	0.0620	3.4379	

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E6 Intermediate floor within a dwelling	45.3000	0.0000	0.0000	
E16 Corner (normal)	21.8000	0.0350	0.7630	
E10 Eaves (insulation at ceiling level)	55.4500	0.5100	28.2795	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				47.5782 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =		147.5685 (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	124.0770	123.3724	122.6818	119.4378	118.8309	116.0054	116.0054	115.4822	117.0938	118.8309	120.0587	121.3423	(38)
Heat transfer coeff	271.6456	270.9410	270.2503	267.0063	266.3994	263.5740	263.5740	263.0507	264.6623	266.3994	267.6272	268.9108	(39)
Average = Sum(39)m / 12 =												267.0034	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1530	1.1500	1.1471	1.1333	1.1307	1.1187	1.1187	1.1165	1.1234	1.1307	1.1359	1.1414	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (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	91.4794	90.1208	88.2076	84.6801	82.0386	79.1097	77.5277	79.4275	81.4960	84.6301	88.2303	91.1702	(42b)
Hot water usage for other uses	48.2597	46.5048	44.7499	42.9950	41.2401	39.4852	39.4852	41.2401	42.9950	44.7499	46.5048	48.2597	(42c)
Average daily hot water use (litres/day)												128.6883	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	139.7391	136.6256	132.9575	127.6751	123.2787	118.5949	117.0129	120.6676	124.4910	129.3800	134.7351	139.4299	(44)
Energy content (annual)	221.3126	194.5531	204.3508	174.7808	165.9569	145.8263	141.5170	149.4117	153.5099	175.5674	191.9548	218.3135	(45)
Distribution loss (46)m = 0.15 x (45)m												2137.0547	
Distribution loss	33.1969	29.1830	30.6526	26.2171	24.8935	21.8739	21.2275	22.4118	23.0265	26.3351	28.7932	32.7470	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0180	(48)
Temperature factor from Table 2b												0.7800	(49)
Enter (49) or (54) in (55)												1.5740	(55)
Total storage loss													
48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	(56)
If cylinder contains dedicated solar storage													
48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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													
324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	321.9663	(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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	(64)
12Total per year (kWh/year)												3233.1409	(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	117.4725	104.3279	111.8327	100.5850	99.0667	66.4969	65.6643	68.2893	69.0516	102.2622	106.2954	116.4753	(65)

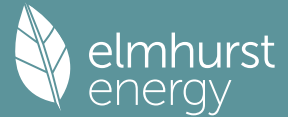
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.8411	226.7884	204.8411	211.6692	204.8411	211.6692	204.8411	204.8411	211.6692	204.8411	211.6692	204.8411	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	403.7362	407.9257	397.3682	374.8927	346.5213	319.8562	302.0423	297.8528	308.4103	330.8858	359.2572	385.9223	(68)
Pumps, fans	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	(71)
Total internal gains	157.8932	155.2499	150.3128	139.7014	133.1542	92.3567	88.2585	91.7867	95.9051	137.4492	147.6325	156.5528	(72)
835.1936	858.6871	821.2453	794.9864	753.2398	692.6053	663.8651	663.2038	684.7076	741.8993	787.2820	816.0394	816.0394	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				16.6600	10.6334		0.5700		0.7000		0.7700		48.9839 (74)
East				1.3400	19.6403		0.5700		0.7000		0.7700		7.2771 (76)
South				3.6400	46.7521		0.5700		0.7000		0.7700		47.0553 (78)
West				4.8300	19.6403		0.5700		0.7000		0.7700		26.2301 (80)
North				2.3300	10.6334		0.5700		0.7000		0.7700		6.8507 (74)
South				25.6600	46.7521		0.5700		0.7000		0.7700		331.7138 (78)
Solar gains	468.1109	792.5761	1079.4464	1341.7521	1515.9098	1513.1228	1455.2298	1322.4356	1168.9870	873.8729	559.6292	401.3925	(83)
Total gains	1303.3045	1651.2632	1900.6917	2136.7384	2269.1496	2205.7281	2119.0948	1985.6394	1853.6946	1615.7723	1346.9112	1217.4319	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.1571	35.2486	35.3386	35.7680	35.8495	36.2338	36.2338	36.3058	36.0848	35.8495	35.6850	35.5147
alpha	3.3438	3.3499	3.3559	3.3845	3.3900	3.4156	3.4156	3.4204	3.4057	3.3900	3.3790	3.3676
util living area	0.9889	0.9756	0.9525	0.9001	0.8049	0.6611	0.5133	0.5601	0.7672	0.9261	0.9792	0.9911 (86)
Living	19.2575	19.5088	19.8352	20.2410	20.5763	20.7925	20.8729	20.8598	20.7026	20.2577	19.6829	19.2206
Non living	17.9045	18.2253	18.6386	19.1489	19.5457	19.7837	19.8518	19.8453	19.6972	19.1803	18.4574	17.8640
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	18
16 / 9	0	28	31	0	0	0	0	0	0	0	23	13
MIT	21.0000	20.1554	20.3403	20.2410	20.5763	20.7925	20.8729	20.8598	20.7026	20.2577	20.1208	20.5774 (87)
Th 2	19.9578	19.9602	19.9626	19.9737	19.9758	19.9856	19.9856	19.9874	19.9818	19.9758	19.9716	19.9672 (88)
util rest of house	0.9866	0.9707	0.9426	0.8783	0.7610	0.5842	0.4081	0.4549	0.7014	0.9054	0.9741	0.9893 (89)
MIT 2	19.9578	19.1944	19.3782	19.1489	19.5457	19.7837	19.8518	19.8453	19.6972	19.1803	19.1059	19.5779 (90)
Living area fraction									fLA =	Living area / (4) =		0.2618 (91)
MIT	20.2306	19.4460	19.6300	19.4348	19.8155	20.0477	20.1191	20.1108	19.9604	19.4623	19.3715	19.8395 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2306	19.4460	19.6300	19.4348	19.8155	20.0477	20.1191	20.1108	19.9604	19.4623	19.3715	19.8395 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9677	0.9388	0.8647	0.7532	0.5893	0.4227	0.4686	0.6999	0.8924	0.9704	0.9890	(94)
Useful gains	1286.7455	1598.0047	1784.4079	1847.5623	1709.0685	1299.7700	895.6795	930.4107	1297.3686	1441.8689	1307.0105	1204.0701	(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	4327.4754	3941.1057	3548.3967	2812.8591	2161.9539	1435.8820	927.5340	976.1341	1551.0263	2360.9182	3284.1938	4205.6348	(97)
Space heating kWh	2262.3030	1574.5639	1312.4077	695.0137	336.9468	0.0000	0.0000	0.0000	0.0000	683.7727	1423.5720	2233.1641	(98a)
Space heating requirement - total per year (kWh/year)												10521.7439	
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	2262.3030	1574.5639	1312.4077	695.0137	336.9468	0.0000	0.0000	0.0000	0.0000	683.7727	1423.5720	2233.1641	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10521.7439	
Space heating per m2											(98c) / (4) =	44.6594	(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 %)													227.1751 (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	2262.3030	1574.5639	1312.4077	695.0137	336.9468	0.0000	0.0000	0.0000	0.0000	683.7727	1423.5720	2233.1641	(98)
Space heating efficiency (main heating system 1)	227.1751	227.1751	227.1751	227.1751	227.1751	0.0000	0.0000	0.0000	0.0000	227.1751	227.1751	227.1751	(210)
Space heating fuel (main heating system)	995.8409	693.1057	577.7074	305.9374	148.3203	0.0000	0.0000	0.0000	0.0000	300.9892	626.6407	983.0143	(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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	(64)
Efficiency of water heater	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	(216)
(217)m	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	(217)
Fuel for water heating, kWh/month	167.8267	148.8264	159.0668	142.0688	139.2385	111.3246	110.2995	114.3767	115.2927	144.2018	150.9382	166.2778	(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	45.0255	36.1212	32.5231	23.8278	18.4053	15.0373	16.7899	21.8242	28.3474	37.1934	42.0098	46.2769	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-221.8654	-352.1627	-555.1822	-666.8421	-709.7273	-488.4455	-481.4611	-485.9203	-493.4236	-427.1464	-258.4538	-187.7557	(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)
(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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-1.9884	-8.6686	-29.1852	-78.4570	-182.4964	-378.1325	-378.0735	-283.2556	-135.5857	-25.5777	-4.4745	-1.3699	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4631.5559	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												193.6316	
Water heating fuel used												1669.7385	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)

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Electricity for lighting (calculated in Appendix L)	363.3819 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-6835.6511 (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	-170.9748 (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	4631.5559	0.1556	720.7242 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1669.7385	0.1415	236.1850 (264)
Space and water heating			956.9092 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	363.3819	0.1443	52.4472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5328.3860	0.1353	-720.8944
PV Unit electricity exported	-1507.2651	0.1084	-163.3679
Total			-884.2623 (269)
Total CO2, kg/year			125.0941 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.5300 (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	4631.5559	1.5761	7299.6852 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.7385	1.5231	2543.1337 (278)
Space and water heating			9842.8189 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	363.3819	1.5338	557.3673 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5328.3860	1.5001	-7993.1277
PV Unit electricity exported	-1507.2651	0.3960	-596.8431
Total			-8589.9707 (283)
Total Primary energy kWh/year			1810.2154 (286)
Dwelling Primary energy Rate (DPER)			7.6800 (287)

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

1. Overall dwelling characteristics

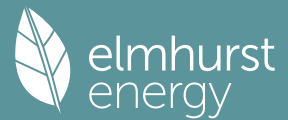
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	642.0100 (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) = 0.0623 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3123 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3123 (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												

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Effective ac	0.3982	0.3904	0.3826	0.3435	0.3357	0.2967	0.2967	0.2889	0.3123	0.3357	0.3513	0.3670 (22b)
	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5673 (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 Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.20)			54.4600	1.1450	62.3588		(27)
Heatloss Floor 1			117.8000	0.1300	15.3140		(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1800	35.1304		(29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756		(30)
Total net area of external elements Aum(A, m2)			487.5490				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 127.9388		(33)

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

145.9296 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	43.5800	0.0500	2.1790
E3 Sill	27.6000	0.0500	1.3800
E4 Jamb	77.6900	0.0500	3.8845
E5 Ground floor (normal)	55.4500	0.1600	8.8720
E6 Intermediate floor within a dwelling	45.3000	0.0000	0.0000
E16 Corner (normal)	21.8000	0.0900	1.9620
E10 Eaves (insulation at ceiling level)	55.4500	0.0600	3.3270

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

21.6045 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 149.5433 (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	122.7275	122.0753	121.4360	118.4333	117.8715	115.2562	115.2562	114.7719	116.2636	117.8715	119.0080	120.1962 (38)
Average = Sum(39)m / 12 =	272.2708	271.6186	270.9793	267.9766	267.4148	264.7995	264.7995	264.3152	265.8069	267.4148	268.5513	269.7395 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1556	1.1529	1.1502	1.1374	1.1350	1.1239	1.1239	1.1219	1.1282	1.1350	1.1399	1.1449 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (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	86.9054	85.6148	83.7972	80.4460	77.9367	75.1542	73.6513	75.4561	77.4212	80.3986	83.8188	86.6116	(42b)
Hot water usage for other uses	45.8467	44.1796	42.5124	40.8453	39.1781	37.5110	37.5110	39.1781	40.8453	42.5124	44.1796	45.8467	(42c)
Average daily hot water use (litres/day)													122.2539 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	132.7522	129.7943	126.3097	121.2913	117.1148	112.6652	111.1623	114.6342	118.2665	122.9110	127.9983	132.4584 (44)
Energy content (annual)	210.2470	184.8254	194.1332	166.0417	157.6590	138.5350	134.4411	141.9411	145.8344	166.7890	182.3571	207.3978 (45)
Distribution loss (46)m = 0.15 x (45)m	31.5370	27.7238	29.1200	24.9063	23.6489	20.7803	20.1662	21.2912	21.8752	25.0184	27.3536	31.1097 (46)

Water storage loss:

Store volume

300.0000 (47)

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

Temperature factor from Table 2b

2.1127 (48)

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

0.5400 (49)

Total storage loss

1.1409 (55)

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
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If cylinder contains dedicated solar storage

35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (57)
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Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
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Total heat required for water heating calculated for each month

268.8758	237.7805	252.7621	222.7793	216.2879	195.2726	193.0699	200.5699	202.5720	225.4178	239.0947	266.0266 (62)
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WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
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FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
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FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
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Output from w/h	268.8758	237.7805	252.7621	222.7793	216.2879	195.2726	193.0699	200.5699	202.5720	225.4178	239.0947	266.0266 (64)
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Total per year (kWh/year) = Sum(64)m = 2720.5090 (64)

Electric shower(s)

2721 (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	0.0000 (64a)
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Total Energy used by instantaneous electric shower(s) = Sum(64a)m = 0.0000 (64a)

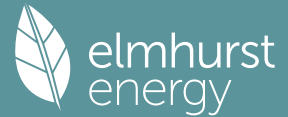
Heat gains from water heating, kWh/month

116.8102	103.8185	111.4524	100.5989	99.3247	91.4529	91.6047	94.0985	93.8800	102.3604	106.0238	115.8628 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.6385	225.4569	203.6385	210.4265	203.6385	210.4265	203.6385	203.6385	210.4265	203.6385	210.4265	203.6385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.7362	407.9257	397.3682	374.8927	346.5213	319.8562	302.0423	297.8528	308.4103	330.8858	359.2572	385.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410 (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)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284 (71)
Water heating gains (Table 5)												

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Total internal gains	157.0029	154.4918	149.8015	139.7207	133.5009	127.0180	123.1246	126.4764	130.3889	137.5812	147.2553	155.7296 (72)
	836.1008	859.5976	822.5315	796.7630	755.3839	726.0238	697.5286	696.6909	717.9488	743.8287	788.6621	817.0135 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	18.9900		10.6334		0.6300		0.7000		0.7700		61.7119 (74)	
East	1.3400		19.6403		0.6300		0.7000		0.7700		8.0431 (76)	
South	29.3000		46.7521		0.6300		0.7000		0.7700		418.6395 (78)	
West	4.8300		19.6403		0.6300		0.7000		0.7700		28.9912 (80)	
Solar gains	517.3857	876.0052	1193.0724	1482.9891	1675.4793	1672.3989	1608.4119	1461.6393	1292.0382	965.8596	618.5376	443.6444 (83)
Total gains	1353.4865	1735.6028	2015.6038	2279.7522	2430.8632	2398.4227	2305.9405	2158.3302	2009.9870	1709.6882	1407.1996	1260.6579 (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	35.0764	35.1606	35.2436	35.6385	35.7134	36.0661	36.0661	36.1322	35.9294	35.7134	35.5622	35.4056
alpha	3.3384	3.3440	3.3496	3.3759	3.3809	3.4044	3.4044	3.4088	3.3953	3.3809	3.3708	3.3604
util living area	0.9876	0.9721	0.9449	0.8850	0.7805	0.6255	0.4795	0.5255	0.7359	0.9156	0.9764	0.9902 (86)
MIT	18.8263	19.1799	19.6270	20.1664	20.5984	20.8671	20.9595	20.9443	20.7579	20.1722	19.3959	18.7702 (87)
Th 2	19.9556	19.9579	19.9601	19.9704	19.9723	19.9813	19.9813	19.9830	19.9779	19.9723	19.9684	19.9643 (88)
util rest of house	0.9851	0.9664	0.9336	0.8609	0.7341	0.5486	0.3787	0.4235	0.6674	0.8927	0.9707	0.9881 (89)
MIT 2	17.4104	17.8600	18.4237	19.0937	19.5986	19.8855	19.9619	19.9541	19.7845	19.1160	18.1448	17.3443 (90)
Living area fraction	17.7810	18.2055	18.7386	19.3745	19.8603	20.1425	20.2230	20.2133	20.0393	19.3924	18.4723	17.7175 (92)
Temperature adjustment	17.7810	18.2055	18.7386	19.3745	19.8603	20.1425	20.2230	20.2133	20.0393	19.3924	18.4723	0.0000
adjusted MIT	17.7810	18.2055	18.7386	19.3745	19.8603	20.1425	20.2230	20.2133	20.0393	19.3924	18.4723	17.7175 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9771	0.9533	0.9164	0.8443	0.7285	0.5615	0.4035	0.4477	0.6720	0.8765	0.9590	0.9814 (94)
Useful gains	1322.5135	1654.6238	1847.1660	1924.7603	1770.7804	1346.7517	930.4611	966.3905	1350.6163	1498.5504	1349.5588	1237.1809 (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	3670.4906	3614.0131	3316.4194	2806.9178	2182.1934	1467.6438	959.3663	1007.9129	1578.6959	2351.2302	3054.0397	3646.2154 (97)
Space heating kWh	1746.8950	1316.7096	1093.1245	635.1534	306.0912	0.0000	0.0000	0.0000	0.0000	634.3938	1227.2262	1792.3217 (98a)
Space heating requirement - total per year (kWh/year)												8751.9154
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	1746.8950	1316.7096	1093.1245	635.1534	306.0912	0.0000	0.0000	0.0000	0.0000	634.3938	1227.2262	1792.3217 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8751.9154
Space heating per m2										(98c) / (4) =		37.1473 (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	1746.8950	1316.7096	1093.1245	635.1534	306.0912	0.0000	0.0000	0.0000	0.0000	634.3938	1227.2262	1792.3217 (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)	1892.6273	1426.5543	1184.3170	688.1402	331.6264	0.0000	0.0000	0.0000	0.0000	687.3172	1329.6059	1941.8436 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	268.8758	237.7805	252.7621	222.7793	216.2879	195.2726	193.0699	200.5699	202.5720	225.4178	239.0947	266.0266 (64)
Efficiency of water heater (217)m	87.4839	87.2940	86.9582	86.2734	84.8383	79.8000	79.8000	79.8000	79.8000	86.2498	87.1965	79.8000 (216)
Fuel for water heating, kWh/month	307.3431	272.3903	290.6709	258.2248	254.9412	244.7025	241.9423	251.3408	253.8496	261.3548	274.2023	303.9463 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	42.3121	33.9443	30.5631	22.3918	17.2961	14.1311	15.7781	20.5089	26.6391	34.9519	39.4781	43.4880 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-95.9728	-128.6493	-175.8426	-187.5389	-193.8246	-177.6938	-175.1344	-169.0927	-157.7157	-141.7061	-102.9498	-83.7432 (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)												

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(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	-76.5096	-157.7278	-307.8902	-454.7102	-594.1802	-594.7600	-588.0787	-501.3990	-371.9820	-223.3180	-101.3573	-60.7833	(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												9482.0319	(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												3214.9086	(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)												341.4826	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-5822.5601	(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												7301.8629	(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	9482.0319	0.2100	1991.2267	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3214.9086	0.2100	675.1308	(264)
Space and water heating			2666.3575	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	341.4826	0.1443	49.2865	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1789.8638	0.1357	-242.9447	
PV Unit electricity exported	-4032.6963	0.1264	-509.6824	
Total			-752.6271	(269)
Total CO2, kg/year			1974.9462	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.3800	(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	9482.0319	1.1300	10714.6961	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3214.9086	1.1300	3632.8467	(278)
Space and water heating			14347.5427	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	341.4826	1.5338	523.7774	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1789.8638	1.5017	-2687.8597	
PV Unit electricity exported	-4032.6963	0.4639	-1870.9692	
Total			-4558.8289	(283)
Total Primary energy kWh/year			10442.5921	(286)
Target Primary Energy Rate (TPER)			44.3200	(287)

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

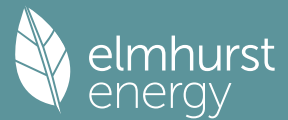
1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	117.8000 (1b)	x	2.7500 (2b)	=	323.9500 (1b)	- (3b)
First floor	117.8000 (1c)	x	2.7000 (2c)	=	318.0600 (1c)	- (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	235.6000					(4)
Dwelling volume				(3a) + (3b) + (3c) + (3d) + (3e)... (3n) =	642.0100	(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)

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Number of passive vents
Number of flueless gas fires

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

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

Air changes per hour
40.0000 / (5) = 0.0623 (8)
Yes
Blower Door
4.0000 (17)
0.2623 (18)
0 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
(21) = (18) x (20) = 0.2623 (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	0.3344	0.3279	0.3213	0.2885	0.2820	0.2492	0.2492	0.2426	0.2623	0.2820	0.2951	0.3082	(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	0.5559	0.5538	0.5516	0.5416	0.5398	0.5310	0.5310	0.5294	0.5344	0.5398	0.5435	0.5475	(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	
Windows (Uw = 0.80)			26.4700	0.7752	20.5194			(27)
Glazed Doors (Uw = 0.80)			27.9900	0.7752	21.6977			(27)
Solid Door			2.1600	1.0000	2.1600			(26)
Heatloss Floor 1			117.8000	0.1300	15.3140			(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600	(29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400	(30)
Total net area of external elements Aum(A, m ²)			487.5490					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.9903			(33)
Internal Wall 1			510.0000			9.0000	4590.0000	(32c)
Internal Ceiling 1			156.1900			9.0000	1405.7100	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 34381.0100 (34)
145.9296 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	43.5800	0.3060	13.3355	
E3 Sill	27.6000	0.0160	0.4416	
E4 Jamb	77.6900	0.0170	1.3207	
E5 Ground floor (normal)	55.4500	0.0620	3.4379	
E6 Intermediate floor within a dwelling	45.3000	0.0000	0.0000	
E16 Corner (normal)	21.8000	0.0350	0.7630	
E10 Eaves (insulation at ceiling level)	55.4500	0.5100	28.2795	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 147.5685 (37)

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

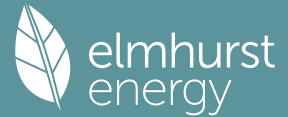
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	117.7800	117.3199	116.8689	114.7507	114.3544	112.5095	112.5095	112.1679	113.2201	114.3544	115.1561	115.9943	(38)
Heat transfer coeff	265.3485	264.8884	264.4374	262.3192	261.9229	260.0780	260.0780	259.7364	260.7886	261.9229	262.7246	263.5628	(39)
Average = Sum(39)m / 12 =												262.3173	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1.1263	1.1243	1.1224	1.1134	1.1117	1.1039	1.1039	1.1024	1.1069	1.1117	1.1151	1.1187	(40)
HLP (average)												1.1134	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													32.5169 (42b)
Hot water usage for other uses													45.8467 (42c)
Average daily hot water use (litres/day)													71.8271 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	78.3636	76.2135	73.8663	70.9453	68.3392	65.6309	65.0686	67.4111	69.8135	72.5946	75.5415	78.2537	(44)
Energy conte	124.1088	108.5270	113.5298	97.1205	91.9977	80.7009	78.6948	83.4690	86.0870	98.5102	107.6227	122.5263	(45)
Energy content (annual)										Total = Sum(45)m =		1192.8948	
Distribution loss (46)m = 0.15 x (45)m													0.0000 (46)
Water storage loss:													
Total storage loss													0.0000 (56)
If cylinder contains dedicated solar storage													0.0000 (57)
Primary loss													0.0000 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month	105.4925	92.2480	96.5003	82.5524	78.1980	68.5958	66.8906	70.9486	73.1740	83.7337	91.4793	104.1474	(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	105.4925	92.2480	96.5003	82.5524	78.1980	68.5958	66.8906	70.9486	73.1740	83.7337	91.4793	104.1474	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1013.9605	(64)
Electric shower(s)	60.3254	53.7505	58.6934	56.0104	57.0615	54.4311	56.2455	57.0615	56.0104	58.6934	57.5898	60.3254	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												686.1984	(64a)

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Heat gains from water heating, kWh/month
41.4545 36.4996 38.7984 34.6407 33.8149 30.7567 30.7840 32.0025 32.2961 35.6068 37.2673 41.1182 (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	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	204.8411	226.7884	204.8411	211.6692	204.8411	211.6692	204.8411	204.8411	211.6692	204.8411	211.6692	204.8411	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.7362	407.9257	397.3682	374.8927	346.5213	319.8562	302.0423	297.8528	308.4103	330.8858	359.2572	385.9223	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	(71)
Water heating gains (Table 5)	55.7184	54.3149	52.1484	48.1121	45.4501	42.7177	41.3764	43.0141	44.8557	47.8586	51.7601	55.2664	(72)
Total internal gains	733.0188	757.7521	723.0809	703.3971	665.5357	642.9662	616.9830	614.4312	633.6582	652.3087	691.4096	714.7529	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				16.6600	10.6334		0.5700		0.7000		0.7700		48.9839 (74)
East				1.3400	19.6403		0.5700		0.7000		0.7700		7.2771 (76)
South				3.6400	46.7521		0.5700		0.7000		0.7700		47.0553 (78)
West				4.8300	19.6403		0.5700		0.7000		0.7700		26.2301 (80)
North				2.3300	10.6334		0.5700		0.7000		0.7700		6.8507 (74)
South				25.6600	46.7521		0.5700		0.7000		0.7700		331.7138 (78)
Solar gains	468.1109	792.5761	1079.4464	1341.7521	1515.9098	1513.1228	1455.2298	1322.4356	1168.9870	873.8729	559.6292		401.3925 (83)
Total gains	1201.1297	1550.3282	1802.5274	2045.1492	2181.4455	2156.0890	2072.2127	1936.8668	1802.6452	1526.1816	1251.0388		1116.1454 (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	35.9915	36.0540	36.1155	36.4071	36.4622	36.7208	36.7208	36.7691	36.6208	36.4622	36.3509	36.2353	
alpha	3.3994	3.4036	3.4077	3.4271	3.4308	3.4481	3.4481	3.4513	3.4414	3.4308	3.4234	3.4157	
util living area	0.9914	0.9794	0.9580	0.9080	0.8150	0.6665	0.5179	0.5664	0.7742	0.9347	0.9831	0.9932	(86)
MIT	18.7881	19.1245	19.5600	20.0978	20.5490	20.8438	20.9511	20.9328	20.7228	20.1109	19.3417	18.7297	(87)
Th 2	19.9794	19.9810	19.9826	19.9899	19.9913	19.9977	19.9977	19.9988	19.9952	19.9913	19.9885	19.9856	(88)
util rest of house	0.9895	0.9752	0.9491	0.8876	0.7726	0.5904	0.4132	0.4616	0.7097	0.9161	0.9789	0.9918	(89)
MIT 2	17.9509	18.2854	18.7154	19.2407	19.6580	19.9077	19.9788	19.9709	19.8181	19.2637	18.5086	17.8970	(90)
Living area fraction									FLA = Living area / (4) =				0.2618 (91)
MIT	18.1700	18.5050	18.9365	19.4650	19.8912	20.1527	20.2333	20.2227	20.0549	19.4854	18.7267	18.1150	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1700	18.5050	18.9365	19.4650	19.8912	20.1527	20.2333	20.2227	20.0549	19.4854	18.7267	18.1150	(93)

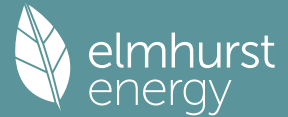
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9669	0.9373	0.8749	0.7678	0.6030	0.4389	0.4864	0.7140	0.9043	0.9717	0.9880	(94)
Useful gains	1183.0153	1499.0423	1689.5861	1789.3797	1674.9707	1300.1962	909.5822	942.0712	1287.0633	1380.1334	1215.5818	1102.7272	(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	3680.3867	3603.8092	3288.6686	2771.4140	2145.4656	1444.1457	944.9435	992.8833	1552.9731	2327.3025	3054.6175	3667.4721	(97)
Space heating kWh	1858.0443	1414.4033	1189.7173	707.0647	350.0482	0.0000	0.0000	0.0000	0.0000	704.6938	1324.1057	1908.1702	(98a)
Space heating requirement - total per year (kWh/year)												9456.2476	
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	1858.0443	1414.4033	1189.7173	707.0647	350.0482	0.0000	0.0000	0.0000	0.0000	704.6938	1324.1057	1908.1702	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9456.2476	
Space heating per m2										(98c) / (4) =		40.1369	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2444.7334	1924.5774	1973.9965	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7719	0.8428	0.8115	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1886.9870	1622.0413	1601.8503	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2423.9246	2329.7716	2175.7491	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	386.5951	526.5514	426.9807	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	96.6488	131.6378	106.7452	0.0000	0.0000	0.0000	0.0000	(107)

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Space cooling requirement	335.0318 (107)
Energy for space heating	40.1369 (99)
Energy for space cooling	1.4220 (108)
Total	41.5589 (109)
Fabric Energy Efficiency (DFEE)	41.6 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 642.0100 (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) = 0.0623 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3123 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3123 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3982	0.3904	0.3826	0.3435	0.3357	0.2967	0.2967	0.2889	0.3123	0.3357	0.3513	0.3670 (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	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5673 (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
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.20)			54.4600	1.1450	62.3588		(27)
Heatloss Floor 1			117.8000	0.1300	15.3140		(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1800	35.1304		(29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756		(30)
Total net area of external elements Aum(A, m ²)			487.5490				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 127.9388		(33)

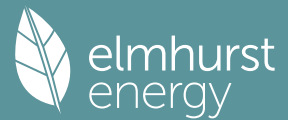
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.9296 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	43.5800	0.0500	2.1790
E1 Steel lintel with perforated steel base plate	27.6000	0.0500	1.3800
E3 Sill	77.6900	0.0500	3.8845
E4 Jamb	55.4500	0.1600	8.8720
E5 Ground floor (normal)	45.3000	0.0000	0.0000
E6 Intermediate floor within a dwelling	21.8000	0.0900	1.9620
E16 Corner (normal)	55.4500	0.0600	3.3270
E10 Eaves (insulation at ceiling level)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			21.6045 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 149.5433 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	122.7275	122.0753	121.4360	118.4333	117.8715	115.2562	115.2562	114.7719	116.2636	117.8715	119.0080	120.1962 (38)
Heat transfer coeff	272.2708	271.6186	270.9793	267.9766	267.4148	264.7995	264.7995	264.3152	265.8069	267.4148	268.5513	269.7395 (39)
Average = Sum(39)m / 12 =												267.9739

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1556	1.1529	1.1502	1.1374	1.1350	1.1239	1.1239	1.1219	1.1282	1.1350	1.1399	1.1449 (40)
HLP (average)												1.1374
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0482 (42)
Hot water usage for mixer showers												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
32.5169	32.0339	31.3539	30.1000	29.1611	28.1200	27.5576	28.2329	28.9682	30.0822	31.3619	32.4069	(42b)
Hot water usage for other uses												
45.8467	44.1796	42.5124	40.8453	39.1781	37.5110	37.5110	39.1781	40.8453	42.5124	44.1796	45.8467	(42c)
Average daily hot water use (litres/day)												71.8271 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
78.3636	76.2135	73.8663	70.9453	68.3392	65.6309	65.0686	67.4111	69.8135	72.5946	75.5415	78.2537	(44)
Energy content (annual)	124.1088	108.5298	113.5298	97.1205	91.9977	80.7009	78.6948	83.4690	86.0870	98.5102	107.6227	122.5263 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1192.8948
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	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
105.4925	92.2480	96.5003	82.5524	78.1980	68.5958	66.8906	70.9486	73.1740	83.7337	91.4793	104.1474	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
105.4925	92.2480	96.5003	82.5524	78.1980	68.5958	66.8906	70.9486	73.1740	83.7337	91.4793	104.1474	(64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1013.9605 (64)
Electric shower(s)												1014 (64)
60.3254	53.7505	58.6934	56.0104	57.0615	54.4311	56.2455	57.0615	56.0104	58.6934	57.5898	60.3254	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 686.1984 (64a)	
Heat gains from water heating, kWh/month												
41.4545	36.4996	38.7984	34.6407	33.8149	30.7567	30.7840	32.0025	32.2961	35.6068	37.2673	41.1182	(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	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105	152.4105 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	203.6385	225.4569	203.6385	210.4265	203.6385	210.4265	203.6385	203.6385	210.4265	203.6385	210.4265	203.6385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.7362	407.9257	397.3682	374.8927	346.5213	319.8562	302.0423	297.8528	308.4103	330.8858	359.2572	385.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410	38.2410 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284 (71)
Water heating gains (Table 5)	55.7184	54.3149	52.1484	48.1121	45.4501	42.7177	41.3764	43.0141	44.8557	47.8586	51.7601	55.2664 (72)
Total internal gains	731.8162	756.4207	721.8784	702.1544	664.3331	641.7235	615.7804	613.2286	632.4156	651.1061	690.1669	713.5503 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				18.9900	10.6334		0.6300		0.7000		0.7700		61.7119 (74)
East				1.3400	19.6403		0.6300		0.7000		0.7700		8.0431 (76)
South				29.3000	46.7521		0.6300		0.7000		0.7700		418.6395 (78)
West				4.8300	19.6403		0.6300		0.7000		0.7700		28.9912 (80)
Solar gains	517.3857	876.0052	1193.0724	1482.9891	1675.4793	1672.3989	1608.4119	1461.6393	1292.0382	965.8596	618.5376	443.6444	(83)
Total gains	1249.2019	1632.4259	1914.9507	2185.1435	2339.8124	2314.1224	2224.1922	2074.8679	1924.4538	1616.9656	1308.7045	1157.1947	(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	35.0764	35.1606	35.2436	35.6385	35.7134	36.0661	36.0661	36.1322	35.9294	35.7134	35.5622	35.4056
alpha	3.3384	3.3440	3.3496	3.3759	3.3809	3.4044	3.4044	3.4088	3.3953	3.3809	3.3708	3.3604
util living area	0.9903	0.9764	0.9517	0.8954	0.7947	0.6414	0.4945	0.5426	0.7536	0.9262	0.9808	0.9924 (86)
MIT	18.7587	19.1168	19.5714	20.1248	20.5727	20.8563	20.9555	20.9385	20.7381	20.1261	19.3344	18.7024 (87)
Th 2	19.9556	19.9579	19.9601	19.9704	19.9723	19.9813	19.9813	19.9830	19.9779	19.9723	19.9684	19.9643 (88)
util rest of house	0.9882	0.9716	0.9416	0.8728	0.7496	0.5643	0.3915	0.4388	0.6864	0.9055	0.9761	0.9908 (89)
MIT 2	17.9052	18.2611	18.7094	19.2494	19.6603	19.8999	19.9645	19.9579	19.8131	19.2627	18.4870	17.8552 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.1286	18.4851	18.9350	19.4786	19.8991	20.1503	20.2239	20.2146	20.0553	19.4887	18.7088	18.0770 (91)
Temperature adjustment												0.0000
adjusted MIT	18.1286	18.4851	18.9350	19.4786	19.8991	20.1503	20.2239	20.2146	20.0553	19.4887	18.7088	18.0770 (92)
												0.0000
												18.0770 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9831	0.9624	0.9289	0.8600	0.7460	0.5780	0.4171	0.4637	0.6921	0.8934	0.9682	0.9865	(94)
Useful gains	1228.0383	1571.1220	1778.7613	1879.2306	1745.5955	1337.4597	927.6344	962.0638	1331.8296	1444.5439	1267.0551	1141.6289	(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	3765.1298	3689.9653	3369.6260	2834.8093	2192.5733	1469.7094	959.6121	1008.2616	1582.9489	2376.9669	3117.5648	3743.1625	(97)
Space heating kWh	1887.5961	1423.8627	1183.6033	688.0167	332.5515	0.0000	0.0000	0.0000	0.0000	693.7228	1332.3670	1935.5410	(98a)
Space heating requirement - total per year (kWh/year)												9477.2611	
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	1887.5961	1423.8627	1183.6033	688.0167	332.5515	0.0000	0.0000	0.0000	0.0000	693.7228	1332.3670	1935.5410	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9477.2611	
Space heating per m2										(98c) / (4) =		40.2261	(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	2489.1155	1959.5165	2008.7956	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7909	0.8577	0.8280	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1968.6934	1680.5842	1663.2428	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2609.9862	2508.7019	2338.3070	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	461.7308	616.1196	502.2478	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	115.4327	154.0299	125.5619	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												395.0245	(107)
Energy for space heating												40.2261	(99)
Energy for space cooling												1.6767	(108)
Total												41.9027	(109)
Fabric Energy Efficiency (TFEE)												41.9	(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)	
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)	
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	642.0100 (5)	

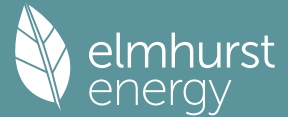
2. Ventilation rate

	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	1 * 10 =	10.0000 (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	7 * 10 =	70.0000 (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) =	80.0000 / (5) =	0.1246 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3246	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3246 (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	0.4139	0.4058	0.3976	0.3571	0.3490	0.3084	0.3084	0.3003	0.3246	0.3490	0.3652	0.3814	(22b)
Effective ac	0.5856	0.5823	0.5791	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727	(25)

3. Heat losses and heat loss parameter

Full SAP Calculation Printout



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						
Windows (Uw = 0.80)			26.4700	0.7752	20.5194			(27)					
Glazed Doors (Uw = 0.80)			27.9900	0.7752	21.6977			(27)					
Solid Door			2.1600	1.0000	2.1600			(26)					
Heatloss Floor 1			117.8000	0.1300	15.3140			(28b)					
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600	(29a)					
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400	(30)					
Total net area of external elements Aum(A, m2)			487.5490					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.9903			(33)					
Internal Wall 1			510.0000			9.0000	4590.0000	(32c)					
Internal Ceiling 1			156.1900			9.0000	1405.7100	(32e)					
Heat capacity Cm = Sum(A x k)													
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					(28)...(30) + (32) + (32a)...(32e) =		34381.0100	(34)					
List of Thermal Bridges							145.9296	(35)					
K1 Element				Length	Psi-value		Total						
E1 Steel lintel with perforated steel base plate				43.5800	0.3060		13.3355						
E3 Sill				27.6000	0.0160		0.4416						
E4 Jamb				77.6900	0.0170		1.3207						
E5 Ground floor (normal)				55.4500	0.0620		3.4379						
E6 Intermediate floor within a dwelling				45.3000	0.0000		0.0000						
E16 Corner (normal)				21.8000	0.0350		0.7630						
E10 Eaves (insulation at ceiling level)				55.4500	0.5100		28.2795						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							47.5782	(36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss						(33) + (36) + (36a) =	147.5685	(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	124.0770	123.3724	122.6818	119.4378	118.8309	116.0054	116.0054	115.4822	117.0938	118.8309	120.0587	121.3423	(38)
Average = Sum(39)m / 12 =	271.6456	270.9410	270.2503	267.0063	266.3994	263.5740	263.5740	263.0507	264.6623	266.3994	267.6272	268.9108	(39)
												267.0034	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1530	1.1500	1.1471	1.1333	1.1307	1.1187	1.1187	1.1165	1.1234	1.1307	1.1359	1.1414	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

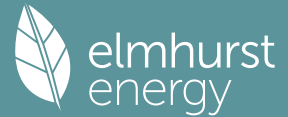
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths													(42b)
Hot water usage for other uses													(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	139.7391	136.6256	132.9575	127.6751	123.2787	118.5949	117.0129	120.6676	124.4910	129.3800	134.7351	139.4299	(44)
Energy content (annual)	221.3126	194.5531	204.3508	174.7808	165.9569	145.8263	141.5170	149.4117	153.5099	175.5674	191.9548	218.3135	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0180 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.5740 (55)
Total storage loss													
If cylinder contains dedicated solar storage													
Primary loss	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	(56)
Combi loss	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	(57)
Total heat required for water heating calculated for each month	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(59)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(62)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63a)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Total per year (kWh/year) = Sum(64)m =	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	(64)
Electric shower(s)													
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	117.4725	104.3279	111.8327	100.5850	99.0667	66.4969	65.6643	68.2893	69.0516	102.2622	106.2954	116.4753	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	51.4405	45.6890	37.1568	28.1301	21.0275	17.7523	19.1820	24.9335	33.4657	42.4924	49.5950	52.8702	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	602.5913	608.8443	593.0869	559.5413	517.1960	477.3974	450.8094	444.5564	460.3138	493.8594	536.2047	576.0034	(68)
Pumps, fans	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	(71)
Total internal gains	157.8932	155.2499	150.3128	139.7014	133.1542	92.3567	88.2585	91.7867	95.9051	137.4492	147.6325	156.5528	(72)
	929.2266	927.0848	897.8581	844.6744	788.6794	704.8081	675.5516	678.5783	706.9863	791.1028	850.7338	902.7280	(73)

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6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North	16.6600				10.6334	0.5700	0.7000	0.7700	48.9839 (74)			
East	1.3400				19.6403	0.5700	0.7000	0.7700	7.2771 (76)			
South	3.6400				46.7521	0.5700	0.7000	0.7700	47.0553 (78)			
West	4.8300				19.6403	0.5700	0.7000	0.7700	26.2301 (80)			
North	2.3300				10.6334	0.5700	0.7000	0.7700	6.8507 (74)			
South	25.6600				46.7521	0.5700	0.7000	0.7700	331.7138 (78)			
Solar gains	468.1109	792.5761	1079.4464	1341.7521	1515.9098	1513.1228	1455.2298	1322.4356	1168.9870	873.8729	559.6292	401.3925 (83)
Total gains	1397.3375	1719.6610	1977.3046	2186.4265	2304.5893	2217.9309	2130.7814	2001.0139	1875.9733	1664.9757	1410.3631	1304.1205 (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	35.1571	35.2486	35.3386	35.7680	35.8495	36.2338	36.2338	36.3058	36.0848	35.8495	35.6850	35.5147
alpha	3.3438	3.3499	3.3559	3.3845	3.3900	3.4156	3.4156	3.4204	3.4057	3.3900	3.3790	3.3676
util living area	0.9864	0.9727	0.9474	0.8948	0.7993	0.6586	0.5109	0.5567	0.7625	0.9205	0.9762	0.9891 (86)
Living	19.3030	19.5402	19.8672	20.2579	20.5843	20.7939	20.8734	20.8607	20.7069	20.2762	19.7125	19.2630
Non living	17.9622	18.2647	18.6780	19.1687	19.5541	19.7848	19.8520	19.8458	19.7012	19.2022	18.4946	17.9181
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	18
16 / 9	0	28	31	0	0	0	0	0	0	0	23	13
MIT	21.0000	20.1732	20.3584	20.2579	20.5843	20.7939	20.8734	20.8607	20.7069	20.2762	20.1405	20.5874 (87)
Th 2	19.9578	19.9602	19.9626	19.9737	19.9758	19.9856	19.9856	19.9874	19.9818	19.9758	19.9716	19.9672 (88)
util rest of house	0.9836	0.9672	0.9366	0.8722	0.7548	0.5817	0.4061	0.4518	0.6963	0.8986	0.9705	0.9869 (89)
MIT 2	19.9578	19.2119	19.3956	19.1687	19.5541	19.7848	19.8520	19.8458	19.7012	19.2022	19.1271	19.5879 (90)
Living area fraction									fLA = Living area / (4) =			0.2618 (91)
MIT	20.2306	19.4635	19.6476	19.4538	19.8238	20.0489	20.1194	20.1115	19.9644	19.4833	19.3924	19.8495 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2306	19.4635	19.6476	19.4538	19.8238	20.0489	20.1194	20.1115	19.9644	19.4833	19.3924	19.8495 (93)

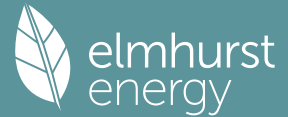
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9844	0.9641	0.9327	0.8586	0.7474	0.5869	0.4206	0.4655	0.6950	0.8855	0.9665	0.9866 (94)
Useful gains	1375.5814	1657.9392	1844.2720	1877.1657	1722.3450	1301.7252	896.2366	931.4798	1303.8600	1474.3988	1363.1521	1286.6053 (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	4327.4754	3945.8501	3553.1497	2817.9343	2164.1638	1436.1920	927.6230	976.3041	1552.0892	2366.5071	3289.7818	4208.3301 (97)
Space heating kWh	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633 (98a)
Space heating requirement - total per year (kWh/year)												10235.8221
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	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10235.8221
Space heating per m2										(98c) / (4) =		43.4458 (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 %)												227.1751 (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	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633 (98)
Space heating efficiency (main heating system 1)	227.1751	227.1751	227.1751	227.1751	227.1751	0.0000	0.0000	0.0000	0.0000	227.1751	227.1751	227.1751 (210)
Space heating fuel (main heating system)	966.7471	676.7801	559.6585	298.1635	144.6959	0.0000	0.0000	0.0000	0.0000	292.1660	610.6185	956.8667 (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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (64)
Efficiency of water heater (217)m	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316 (216)
Fuel for water heating, kWh/month	167.8267	148.8264	159.0668	142.0688	139.2385	111.3246	110.2995	114.3767	115.2927	144.2018	150.9382	166.2778 (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	45.0255	36.1212	32.5231	23.8278	18.4053	15.0373	16.7899	21.8242	28.3474	37.1934	42.0098	46.2769 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-221.8171	-352.0129	-554.5974	-665.9443	-706.1030	-488.4455	-481.4611	-485.9203	-493.4236	-426.7949	-258.3726	-187.7252 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-2.0367	-8.8184	-29.7700	-79.3547	-186.1207	-378.1325	-378.0735	-283.2556	-135.5857	-25.9292	-4.5557	-1.4004 (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	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												4505.6963 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.6316
Water heating fuel used												1669.7385 (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)												363.3819 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-6835.6511 (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												-296.8344 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4505.6963	16.4900	742.9893 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.7385	16.4900	275.3399 (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	363.3819	16.4900	59.9217 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5322.6178	16.4900	-877.6997
PV Unit electricity exported	-1513.0333	5.5900	-84.5786
Total			-962.2782 (252)
Total energy cost			115.9726 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.1488 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	97.5881
SAP rating (Section 12)		98 (258)
SAP band		A

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

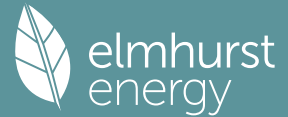
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4505.6963	0.1556	701.1368 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1669.7385	0.1415	236.1850 (264)
Space and water heating			937.3218 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	363.3819	0.1443	52.4472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5322.6178	0.1353	-720.1012
PV Unit electricity exported	-1513.0333	0.1085	-164.1813
Total			-884.2826 (269)
Total CO2, kg/year			105.4865 (272)
CO2 emissions per m2			0.4500 (273)
EI value			99.4963
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	642.0100 (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												1 * 10 =	10.0000 (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												7 * 10 =	70.0000 (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) =											80.0000 / (5) =	0.1246 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000 (17)	
Infiltration rate												0.3246 (18)	
Number of sides sheltered												0 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3246 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)	
Adj infilt rate	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)	
	0.3733	0.3571	0.3571	0.3327	0.3327	0.3003	0.3003	0.2840	0.3084	0.3408	0.3246	0.3490 (22b)	
Effective ac	0.5697	0.5637	0.5637	0.5554	0.5554	0.5451	0.5451	0.5403	0.5475	0.5581	0.5527	0.5609 (25)	

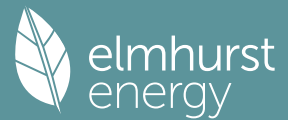
3. Heat losses and heat loss parameter

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						
Windows (Uw = 0.80)			26.4700	0.7752	20.5194			(27)					
Glazed Doors (Uw = 0.80)			27.9900	0.7752	21.6977			(27)					
Solid Door			2.1600	1.0000	2.1600			(26)					
Heatloss Floor 1			117.8000	0.1300	15.3140			(28b)					
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600	(29a)					
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400	(30)					
Total net area of external elements Aum(A, m2)			487.5490					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.9903			(33)					
Internal Wall 1			510.0000			9.0000	4590.0000	(32c)					
Internal Ceiling 1			156.1900			9.0000	1405.7100	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		34381.0100	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							145.9296	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E1 Steel lintel with perforated steel base plate				43.5800	0.3060	13.3355							
E3 Sill				27.6000	0.0160	0.4416							
E4 Jamb				77.6900	0.0170	1.3207							
E5 Ground floor (normal)				55.4500	0.0620	3.4379							
E6 Intermediate floor within a dwelling				45.3000	0.0000	0.0000							
E16 Corner (normal)				21.8000	0.0350	0.7630							
E10 Eaves (insulation at ceiling level)				55.4500	0.5100	28.2795							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							47.5782	(36)					
Point Thermal bridges						(36a) =	0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	147.5685	(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	120.6935	119.4378	119.4378	117.6588	117.6588	115.4822	115.4822	114.4776	116.0054	118.2379	117.0938	118.8309	(38)
Heat transfer coeff	268.2621	267.0063	267.0063	265.2274	265.2274	263.0507	263.0507	262.0462	263.5740	265.8064	264.6623	266.3994	(39)
Average = Sum(39)m / 12 =												265.1099	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1386	1.1333	1.1333	1.1258	1.1258	1.1165	1.1165	1.1123	1.1187	1.1282	1.1234	1.1307	(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												3.0482 (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	91.4794	90.1208	88.2076	84.6801	82.0386	79.1097	77.5277	79.4275	81.4960	84.6301	88.2303	91.1702 (42b)
Hot water usage for other uses	48.2597	46.5048	44.7499	42.9950	41.2401	39.4852	39.4852	41.2401	42.9950	44.7499	46.5048	48.2597 (42c)
Average daily hot water use (litres/day)												128.6883 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	139.7391	136.6256	132.9575	127.6751	123.2787	118.5949	117.0129	120.6676	124.4910	129.3800	134.7351	139.4299 (44)
Energy conte	221.3126	194.5531	204.3508	174.7808	165.9569	145.8263	141.5170	149.4117	153.5099	175.5674	191.9548	218.3135 (45)
Energy content (annual)	Total = Sum(45)m =											2137.0547
Distribution loss (46)m = 0.15 x (45)m	33.1969	29.1830	30.6526	26.2171	24.8935	21.8739	21.2275	22.4118	23.0265	26.3351	28.7932	32.7470 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0180 (48)
Temperature factor from Table 2b												0.7800 (49)
Enter (49) or (54) in (55)												1.5740 (55)
Total storage loss												

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If cylinder contains dedicated solar storage	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952 (56)
Primary loss	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952 (57)
Combi loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
WWHRS	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Electric shower(s)	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (64)
	Total per year (kWh/year) = Sum(64)m =											3233.1409 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
	117.4725	104.3279	111.8327	100.5850	99.0667	66.4969	65.6643	68.2893	69.0516	102.2622	106.2954	116.4753 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.4405	45.6890	37.1568	28.1301	21.0275	17.7523	19.1820	24.9335	33.4657	42.4924	49.5950	52.8702 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.5913	608.8443	593.0869	559.5413	517.1960	477.3974	450.8094	444.5564	460.3138	493.8594	536.2047	576.0034 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284 (71)
Water heating gains (Table 5)	157.8932	155.2499	150.3128	139.7014	133.1542	92.3567	88.2585	91.7867	95.9051	137.4492	147.6325	156.5528 (72)
Total internal gains	929.2266	927.0848	897.8581	844.6744	788.6794	704.8081	675.5516	678.5783	706.9863	791.1028	850.7338	902.7280 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W			
North				16.6600				12.7650		0.5700		0.7000		0.7700		58.8035 (74)	
East				1.3400				23.8018		0.5700		0.7000		0.7700		8.8190 (76)	
South				3.6400				54.2217		0.5700		0.7000		0.7700		54.5734 (78)	
West				4.8300				23.8018		0.5700		0.7000		0.7700		31.7879 (80)	
North				2.3300				12.7650		0.5700		0.7000		0.7700		8.2240 (74)	
South				25.6600				54.2217		0.5700		0.7000		0.7700		384.7122 (78)	
Solar gains		546.9201	809.2325	1086.6264	1394.8320	1538.2960	1629.9527	1549.6033	1434.4264	1260.2248	945.6587	627.9328	471.7799 (83)				
Total gains		1476.1467	1736.3173	1984.4846	2239.5065	2326.9754	2334.7608	2225.1549	2113.0048	1967.2111	1736.7614	1478.6667	1374.5079 (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	35.6006	35.7680	35.7680	36.0079	36.0079	36.3058	36.3058	36.4450	36.2338	35.9295	36.0848	35.8495
alpha	3.3734	3.3845	3.3845	3.4005	3.4005	3.4204	3.4204	3.4297	3.4156	3.3953	3.4057	3.3900
util living area	0.9829	0.9697	0.9413	0.8749	0.7650	0.5755	0.4225	0.4517	0.7108	0.9011	0.9697	0.9861 (86)
Living	19.4180	19.6274	19.9536	20.3510	20.6530	20.8436	20.8929	20.8890	20.7618	20.3637	19.8273	19.3819
Non living	18.1170	18.3851	18.7946	19.2854	19.6334	19.8294	19.8655	19.8673	19.7581	19.3088	18.6470	18.0759
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	16
16 / 9	0	28	31	0	0	0	0	0	0	0	22	15
MIT	21.0000	20.2226	20.4073	20.3510	20.6530	20.8436	20.8929	20.8890	20.7618	20.3637	20.2002	20.5566 (87)
Th 2	19.9694	19.9737	19.9737	19.9799	19.9799	19.9874	19.9874	19.9908	19.9856	19.9779	19.9818	19.9758 (88)
util rest of house	0.9793	0.9635	0.9290	0.8481	0.7133	0.4892	0.3134	0.3401	0.6352	0.8740	0.9624	0.9831 (89)
MIT 2	19.9694	19.2725	19.4533	19.2854	19.6334	19.8294	19.8655	19.8673	19.7581	19.3088	19.1938	19.5701 (90)
Living area fraction									fLA = Living area / (4) =			0.2618 (91)
MIT	20.2392	19.5212	19.7030	19.5643	19.9003	20.0949	20.1345	20.1347	20.0208	19.5849	19.4572	19.8283 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2392	19.5212	19.7030	19.5643	19.9003	20.0949	20.1345	20.1347	20.0208	19.5849	19.4572	19.8283 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9803	0.9603	0.9252	0.8353	0.7088	0.4989	0.3297	0.3566	0.6381	0.8613	0.9577	0.9827 (94)
Ext temp.	1447.1041	1667.3988	1836.1380	1870.6893	1649.4422	1164.9156	733.7337	753.5805	1255.3499	1495.9152	1416.1123	1350.6756 (95)
Heat loss rate W	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Space heating kWh	4168.5702	3797.1605	3391.7828	2669.3323	1989.2837	1234.9862	745.6071	769.0302	1428.7883	2255.3486	3138.1577	4030.1656 (97)
Space heating requirement - total per year (kWh/year)	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98c)

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Space heating per m2

(98c) / (4) = 39.2176 (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 %)												227.3588 (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	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98)
Space heating efficiency (main heating system 1)	227.3588	227.3588	227.3588	227.3588	227.3588	0.0000	0.0000	0.0000	0.0000	227.3588	227.3588	227.3588 (210)
Space heating fuel (main heating system)	890.5619	629.4896	509.0631	252.9143	111.2084	0.0000	0.0000	0.0000	0.0000	248.5140	545.3375	876.8258 (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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (64)
Efficiency of water heater (217)m	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085 (216)
Fuel for water heating, kWh/month	167.8467	148.8442	159.0858	142.0857	139.2551	111.3379	110.3126	114.3903	115.3065	144.2190	150.9562	166.2976 (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	45.0255	36.1212	32.5231	23.8278	18.4053	15.0373	16.7899	21.8242	28.3474	37.1934	42.0098	46.2769 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-261.7546	-363.3404	-562.3187	-686.0132	-672.6321	-488.4588	-481.4742	-485.9339	-493.4374	-461.9442	-292.3166	-222.8984 (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	-3.2414	-10.0587	-32.9081	-94.4033	-235.5099	-446.2432	-435.6544	-352.8817	-191.6368	-34.4522	-6.6574	-2.2703 (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												4063.9147 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.6085
Water heating fuel used												1669.9379 (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)												363.3819 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-7318.4400 (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												-1221.2055 (238)

10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4063.9147	26.0600	1059.0562 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.9379	26.0600	435.1858 (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	363.3819	26.0600	94.6973 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	26.0600	-1426.1394
PV Unit electricity exported	-1845.9175	5.8100	-107.2478
Total			-1533.3872 (252)
Total energy cost			55.5521 (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	4063.9147	0.1559	633.6793 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1669.9379	0.1415	236.2132 (264)
Space and water heating			869.8925 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	363.3819	0.1443	52.4472 (268)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	0.1359	-743.7019
PV Unit electricity exported	-1845.9175	0.1087	-200.7367
Total			-944.4385 (269)
Total CO2, kg/year			-22.0987 (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	4063.9147	1.5773	6409.8234 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.9379	1.5231	2543.4375 (278)
Space and water heating			8953.2608 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	363.3819	1.5338	557.3673 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	1.5024	-8221.7375
PV Unit electricity exported	-1845.9175	0.3974	-733.6420
Total			-8955.3795 (283)
Total Primary energy kWh/year			555.2486 (286)

SAP 10 EPC IMPROVEMENTS

Revised Design

Current energy efficiency rating:	A 98
Current environmental impact rating:	A 99

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

Recommended measures: (none)	SAP change	Cost change	CO2 change
---------------------------------	------------	-------------	------------

Measures omitted - SAP change or cost saving too small:	
N Solar water heating	+ 0.4 -£ 28 -33 kg (151.0%)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings	£0	0.00 kg/m²

Potential energy efficiency rating:	A 98
Potential environmental impact rating:	A 99

Fuel prices for cost data on this page from database revision number 554 TEST (31 Oct 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1589	Potential £1589	Saving £0
Electricity			
Space heating	£1059	£1059	£0
Water heating	£435	£435	£0
Lighting	£95	£95	£0
Generated (PV)	-£1533	-£1533	£0
Total cost of fuels	£56	£56	£0
Total cost of uses	£56	£56	£0
Delivered energy	-5 kWh/m²	-5 kWh/m²	0 kWh/m²
Carbon dioxide emissions	-0.0 tonnes	-0.0 tonnes	0.0 tonnes
CO2 emissions per m²	-0 kg/m²	-0 kg/m²	0 kg/m²
Primary energy	2 kWh/m²	2 kWh/m²	0 kWh/m²

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

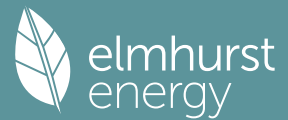
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	235.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 642.0100 (5)

2. Ventilation rate

m3 per hour

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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	1 * 10 =	10.0000 (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	7 * 10 =	70.0000 (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) =	80.0000 / (5) =	0.1246 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3246	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3246	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4139	0.4058	0.3976	0.3571	0.3490	0.3084	0.3084	0.3003	0.3246	0.3490	0.3652	0.3814	(22b)
	0.5856	0.5823	0.5791	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727	(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	
Windows (Uw = 0.80)			26.4700	0.7752	20.5194			(27)
Glazed Doors (Uw = 0.80)			27.9900	0.7752	21.6977			(27)
Solid Door			2.1600	1.0000	2.1600			(26)
Heatloss Floor 1			117.8000	0.1300	15.3140			(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600	(29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400	(30)
Total net area of external elements Aum(A, m2)			487.5490					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	99.9903				(33)
Internal Wall 1			510.0000				4590.0000	(32c)
Internal Ceiling 1			156.1900			9.0000	1405.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	34381.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		145.9296	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate	43.5800	0.3060	13.3355	
E3 Sill	27.6000	0.0160	0.4416	
E4 Jamb	77.6900	0.0170	1.3207	
E5 Ground floor (normal)	55.4500	0.0620	3.4379	
E6 Intermediate floor within a dwelling	45.3000	0.0000	0.0000	
E16 Corner (normal)	21.8000	0.0350	0.7630	
E10 Eaves (insulation at ceiling level)	55.4500	0.5100	28.2795	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			47.5782	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	147.5685 (37)

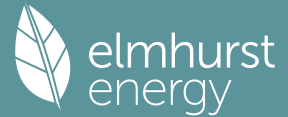
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	124.0770	123.3724	122.6818	119.4378	118.8309	116.0054	116.0054	115.4822	117.0938	118.8309	120.0587	121.3423	(38)
Average = Sum(39)m / 12 =	271.6456	270.9410	270.2503	267.0063	266.3994	263.5740	263.5740	263.0507	264.6623	266.3994	267.6272	268.9108	(39)
												267.0034	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1530	1.1500	1.1471	1.1333	1.1307	1.1187	1.1187	1.1165	1.1234	1.1307	1.1359	1.1414	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (42)
Hot water usage for mixer showers													(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for other uses	91.4794	90.1208	88.2076	84.6801	82.0386	79.1097	77.5277	79.4275	81.4960	84.6301	88.2303	91.1702	(42b)
Average daily hot water use (litres/day)	48.2597	46.5048	44.7499	42.9950	41.2401	39.4852	39.4852	41.2401	42.9950	44.7499	46.5048	48.2597	(42c)
												128.6883	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	139.7391	136.6256	132.9575	127.6751	123.2787	118.5949	117.0129	120.6676	124.4910	129.3800	134.7351	139.4299	(44)
Energy content (annual)	221.3126	194.5531	204.3508	174.7808	165.9569	145.8263	141.5170	149.4117	153.5099	175.5674	191.9548	218.3135	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	33.1969	29.1830	30.6526	26.2171	24.8935	21.8739	21.2275	22.4118	23.0265	26.3351	28.7932	32.7470	(46)
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0180 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.5740 (55)
Total storage loss	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	(56)
If cylinder contains dedicated solar storage	48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	(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)

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (64)
	Total per year (kWh/year) = Sum(64)m =										3233.1409 (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	117.4725	104.3279	111.8327	100.5850	99.0667	66.4969	65.6643	68.2893	69.0516	102.2622	106.2954	116.4753 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.4405	45.6890	37.1568	28.1301	21.0275	17.7523	19.1820	24.9335	33.4657	42.4924	49.5950	52.8702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.5913	608.8443	593.0869	559.5413	517.1960	477.3974	450.8094	444.5564	460.3138	493.8594	536.2047	576.0034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	(71)
Water heating gains (Table 5)	157.8932	155.2499	150.3128	139.7014	133.1542	92.3567	88.2585	91.7867	95.9051	137.4492	147.6325	156.5528	(72)
Total internal gains	929.2266	927.0848	897.8581	844.6744	788.6794	704.8081	675.5516	678.5783	706.9863	791.1028	850.7338	902.7280	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	16.6600	10.6334	0.5700	0.7000	0.7700	48.9839 (74)
East	1.3400	19.6403	0.5700	0.7000	0.7700	7.2771 (76)
South	3.6400	46.7521	0.5700	0.7000	0.7700	47.0553 (78)
West	4.8300	19.6403	0.5700	0.7000	0.7700	26.2301 (80)
North	2.3300	10.6334	0.5700	0.7000	0.7700	6.8507 (74)
South	25.6600	46.7521	0.5700	0.7000	0.7700	331.7138 (78)

Solar gains	468.1109	792.5761	1079.4464	1341.7521	1515.9098	1513.1228	1455.2298	1322.4356	1168.9870	873.8729	559.6292	401.3925 (83)
Total gains	1397.3375	1719.6610	1977.3046	2186.4265	2304.5893	2217.9309	2130.7814	2001.0139	1875.9733	1664.9757	1410.3631	1304.1205 (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	35.1571	35.2486	35.3386	35.7680	35.8495	36.2338	36.2338	36.3058	36.0848	35.8495	35.6850	35.5147
alpha	3.3438	3.3499	3.3559	3.3845	3.3900	3.4156	3.4156	3.4204	3.4057	3.3900	3.3790	3.3676
util living area	0.9864	0.9727	0.9474	0.8948	0.7993	0.6586	0.5109	0.5567	0.7625	0.9205	0.9762	0.9891 (86)
Living	19.3030	19.5402	19.8672	20.2579	20.5843	20.7939	20.8734	20.8607	20.7069	20.2762	19.7125	19.2630
Non living	17.9622	18.2647	18.6780	19.1687	19.5541	19.7848	19.8520	19.8458	19.7012	19.2022	18.4946	17.9181
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	18
16 / 9	0	28	31	0	0	0	0	0	0	0	23	13
MIT	21.0000	20.1732	20.3584	20.2579	20.5843	20.7939	20.8734	20.8607	20.7069	20.2762	20.1405	20.5874 (87)
Th 2	19.9578	19.9602	19.9626	19.9737	19.9758	19.9856	19.9856	19.9874	19.9818	19.9758	19.9716	19.9672 (88)
util rest of house	0.9836	0.9672	0.9366	0.8722	0.7548	0.5817	0.4061	0.4518	0.6963	0.8986	0.9705	0.9869 (89)
MIT 2	19.9578	19.2119	19.3956	19.1687	19.5541	19.7848	19.8520	19.8458	19.7012	19.2022	19.1271	19.5879 (90)
Living area fraction									fLA = Living area / (4) =			0.2618 (91)
MIT	20.2306	19.4635	19.6476	19.4538	19.8238	20.0489	20.1194	20.1115	19.9644	19.4833	19.3924	19.8495 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2306	19.4635	19.6476	19.4538	19.8238	20.0489	20.1194	20.1115	19.9644	19.4833	19.3924	19.8495 (93)

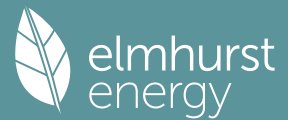
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9844	0.9641	0.9327	0.8586	0.7474	0.5869	0.4206	0.4655	0.6950	0.8855	0.9665	0.9866	(94)
Useful gains	1375.5814	1657.9392	1844.2720	1877.1657	1722.3450	1301.7252	896.2366	931.4798	1303.8600	1474.3988	1363.1521	1286.6053	(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	4327.4754	3945.8501	3553.1497	2817.9343	2164.1638	1436.1920	927.6230	976.3041	1552.0892	2366.5071	3289.7818	4208.3301	(97)
Space heating kWh	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633	(98a)
Space heating requirement - total per year (kWh/year)												10235.8221	
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	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10235.8221	
Space heating per m2											(98c) / (4) =	43.4458	(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)

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Efficiency of main space heating system 1 (in %)												227.1751	(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	2196.2091	1537.4761	1271.4050	677.3534	328.7132	0.0000	0.0000	0.0000	0.0000	663.7285	1387.1734	2173.7633	(98)
Space heating efficiency (main heating system 1)	227.1751	227.1751	227.1751	227.1751	227.1751	0.0000	0.0000	0.0000	0.0000	227.1751	227.1751	227.1751	(210)
Space heating fuel (main heating system)	966.7471	676.7801	559.6585	298.1635	144.6959	0.0000	0.0000	0.0000	0.0000	292.1660	610.6185	956.8667	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	(64)
Efficiency of water heater	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	193.6316	(216)
Fuel for water heating, kWh/month	167.8267	148.8264	159.0668	142.0688	139.2385	111.3246	110.2995	114.3767	115.2927	144.2018	150.9382	166.2778	(217)
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	(219)
(217)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	45.0255	36.1212	32.5231	23.8278	18.4053	15.0373	16.7899	21.8242	28.3474	37.1934	42.0098	46.2769	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-221.8171	-352.0129	-554.5974	-665.9443	-706.1030	-488.4455	-481.4611	-485.9203	-493.4236	-426.7949	-258.3726	-187.7252	(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)	-2.0367	-8.8184	-29.7700	-79.3547	-186.1207	-378.1325	-378.0735	-283.2556	-135.5857	-25.9292	-4.5557	-1.4004	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													4505.6963 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													193.6316
Water heating fuel used													1669.7385 (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)													363.3819 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-6835.6511 (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													-296.8344 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4505.6963	16.4900	742.9893 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.7385	16.4900	275.3399 (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	363.3819	16.4900	59.9217 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5322.6178	16.4900	-877.6997
PV Unit electricity exported	-1513.0333	5.5900	-84.5786
Total			-962.2782 (252)
Total energy cost			115.9726 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.1488 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	97.5881
SAP rating (Section 12)		98 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4505.6963	0.1556	701.1368 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1669.7385	0.1415	236.1850 (264)
Space and water heating			937.3218 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)

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Energy for lighting	363.3819	0.1443	52.4472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5322.6178	0.1353	-720.1012
PV Unit electricity exported	-1513.0333	0.1085	-164.1813
Total			-884.2826 (269)
Total CO ₂ , kg/year			105.4865 (272)
CO ₂ emissions per m ²			0.4500 (273)
EI value			99.4963
EI rating			99 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	117.8000 (1b)	x 2.7500 (2b)	= 323.9500 (1b) - (3b)
First floor	117.8000 (1c)	x 2.7000 (2c)	= 318.0600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 642.0100 (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	1 * 10 = 10.0000 (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	7 * 10 = 70.0000 (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) =	80.0000 / (5) = 0.1246 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3246 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3246 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.3733	0.3571	0.3571	0.3327	0.3327	0.3003	0.3003	0.2840	0.3084	0.3408	0.3246	0.3490 (22b)
Effective ac	0.5697	0.5637	0.5637	0.5554	0.5554	0.5451	0.5451	0.5403	0.5475	0.5581	0.5527	0.5609 (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
Windows (U _w = 0.80)			26.4700	0.7752	20.5194		(27)
Glazed Doors (U _w = 0.80)			27.9900	0.7752	21.6977		(27)
Solid Door			2.1600	1.0000	2.1600		(26)
Heatloss Floor 1			117.8000	0.1300	15.3140		(28b)
External Wall 1	251.7890	56.6200	195.1690	0.1400	27.3237	140.0000	27323.6600 (29a)
External Roof 1	117.9600		117.9600	0.1100	12.9756	9.0000	1061.6400 (30)
Total net area of external elements A _{um} (A, m ²)			487.5490				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.9903		(33)
Internal Wall 1			510.0000			9.0000	4590.0000 (32c)
Internal Ceiling 1			156.1900			9.0000	1405.7100 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				34381.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.9296 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				43.5800	0.3060	13.3355	
E3 Sill				27.6000	0.0160	0.4416	
E4 Jamb				77.6900	0.0170	1.3207	
E5 Ground floor (normal)				55.4500	0.0620	3.4379	
E6 Intermediate floor within a dwelling				45.3000	0.0000	0.0000	
E16 Corner (normal)				21.8000	0.0350	0.7630	
E10 Eaves (insulation at ceiling level)				55.4500	0.5100	28.2795	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							47.5782 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	147.5685 (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	120.6935	119.4378	119.4378	117.6588	117.6588	115.4822	115.4822	114.4776	116.0054	118.2379	117.0938	118.8309 (38)
	268.2621	267.0063	267.0063	265.2274	265.2274	263.0507	263.0507	262.0462	263.5740	265.8064	264.6623	266.3994 (39)

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Average = Sum(39)m / 12 =

265.1099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1386	1.1333	1.1333	1.1258	1.1258	1.1165	1.1165	1.1123	1.1187	1.1282	1.1234	1.1307	(40)
HLP (average)												1.1253	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0482 (42)
Hot water usage for mixer showers													0.0000 (42a)
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	
Hot water usage for baths													91.1702 (42b)
91.4794	90.1208	88.2076	84.6801	82.0386	79.1097	77.5277	79.4275	81.4960	84.6301	88.2303	91.1702	91.1702	
Hot water usage for other uses													48.2597 (42c)
48.2597	46.5048	44.7499	42.9950	41.2401	39.4852	39.4852	41.2401	42.9950	44.7499	46.5048	48.2597	48.2597	
Average daily hot water use (litres/day)													128.6883 (43)
48.2597	46.5048	44.7499	42.9950	41.2401	39.4852	39.4852	41.2401	42.9950	44.7499	46.5048	48.2597	48.2597	
Daily hot water use													
139.7391	136.6256	132.9575	127.6751	123.2787	118.5949	117.0129	120.6676	124.4910	129.3800	134.7351	139.4299	139.4299	(44)
Energy content (annual)													218.3135 (45)
221.3126	194.5531	204.3508	174.7808	165.9569	145.8263	141.5170	149.4117	153.5099	175.5674	191.9548	218.3135	218.3135	
Energy content (annual)													2137.0547
Distribution loss (46)m = 0.15 x (45)m													
33.1969	29.1830	30.6526	26.2171	24.8935	21.8739	21.2275	22.4118	23.0265	26.3351	28.7932	32.7470	32.7470	(46)
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0180 (48)
Temperature factor from Table 2b													0.7800 (49)
Enter (49) or (54) in (55)													1.5740 (55)
Total storage loss													
48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	(56)
If cylinder contains dedicated solar storage													
48.7952	44.0731	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	47.2212	48.7952	47.2212	48.7952	48.7952	(57)
Primary loss													54.8576 (59)
54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	54.8576	
Combi loss													0.0000 (61)
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	
Total heat required for water heating calculated for each month													
324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	321.9663	(62)
WWHRS													0.0000 (63a)
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	
PV diverter													-0.0000 (63b)
-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	
Solar input													0.0000 (63c)
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	
FGHRS													0.0000 (63d)
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	
Output from w/h													
324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663	321.9663	(64)
Total per year (kWh/year) = Sum(64)m =													3233.1409 (64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
117.4725	104.3279	111.8327	100.5850	99.0667	66.4969	65.6643	68.2893	69.0516	102.2622	106.2954	116.4753	116.4753	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	182.8926	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
51.4405	45.6890	37.1568	28.1301	21.0275	17.7523	19.1820	24.9335	33.4657	42.4924	49.5950	52.8702	52.8702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
602.5913	608.8443	593.0869	559.5413	517.1960	477.3974	450.8094	444.5564	460.3138	493.8594	536.2047	576.0034	576.0034	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	56.3375	(69)
Pumps, fans													0.0000 (70)
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	
Losses e.g. evaporation (negative values) (Table 5)													
-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	-121.9284	(71)
Water heating gains (Table 5)													
157.8932	155.2499	150.3128	139.7014	133.1542	92.3567	88.2585	91.7867	95.9051	137.4492	147.6325	156.5528	156.5528	(72)
Total internal gains													
929.2266	927.0848	897.8581	844.6744	788.6794	704.8081	675.5516	678.5783	706.9863	791.1028	850.7338	902.7280	902.7280	(73)

6. Solar gains

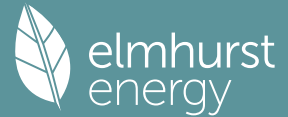
[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	16.6600	12.7650	0.5700	0.7000	0.7700	58.8035 (74)
East	1.3400	23.8018	0.5700	0.7000	0.7700	8.8190 (76)
South	3.6400	54.2217	0.5700	0.7000	0.7700	54.5734 (78)
West	4.8300	23.8018	0.5700	0.7000	0.7700	31.7879 (80)
North	2.3300	12.7650	0.5700	0.7000	0.7700	8.2240 (74)
South	25.6600	54.2217	0.5700	0.7000	0.7700	384.7122 (78)

Solar gains	546.9201	809.2325	1086.6264	1394.8320	1538.2960	1629.9527	1549.6033	1434.4264	1260.2248	945.6587	627.9328	471.7799	(83)
Total gains	1476.1467	1736.3173	1984.4846	2239.5065	2326.9754	2334.7608	2225.1549	2113.0048	1967.2111	1736.7614	1478.6667	1374.5079	(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	35.6006	35.7680	35.7680	36.0079	36.0079	36.3058	36.3058	36.4450	36.2338	35.9295	36.0848	35.8495	
alpha	3.3734	3.3845	3.3845	3.4005	3.4005	3.4204	3.4204	3.4297	3.4156	3.3953	3.4057	3.3900	
util living area													
0.9829	0.9697	0.9413	0.8749	0.7650	0.5755	0.4225	0.4517	0.7108	0.9011	0.9697	0.9861	0.9861	(86)
Living													
19.4180	19.6274	19.9536	20.3510	20.6530	20.8436	20.8929	20.8890	20.7618	20.3637	19.8273	19.3819	19.3819	

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Non living	18.1170	18.3851	18.7946	19.2854	19.6334	19.8294	19.8655	19.8673	19.7581	19.3088	18.6470	18.0759
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	16
16 / 9	0	28	31	0	0	0	0	0	0	0	22	15
MIT	21.0000	20.2226	20.4073	20.3510	20.6530	20.8436	20.8929	20.8890	20.7618	20.3637	20.2002	20.5566 (87)
Th 2	19.9694	19.9737	19.9737	19.9799	19.9799	19.9874	19.9874	19.9908	19.9856	19.9779	19.9818	19.9758 (88)
util rest of house												
	0.9793	0.9635	0.9290	0.8481	0.7133	0.4892	0.3134	0.3401	0.6352	0.8740	0.9624	0.9831 (89)
MIT 2	19.9694	19.2725	19.4533	19.2854	19.6334	19.8294	19.8655	19.8673	19.7581	19.3088	19.1938	19.5701 (90)
Living area fraction									FLA = Living area / (4) =			0.2618 (91)
MIT	20.2392	19.5212	19.7030	19.5643	19.9003	20.0949	20.1345	20.1347	20.0208	19.5849	19.4572	19.8283 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2392	19.5212	19.7030	19.5643	19.9003	20.0949	20.1345	20.1347	20.0208	19.5849	19.4572	19.8283 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9803	0.9603	0.9252	0.8353	0.7088	0.4989	0.3297	0.3566	0.6381	0.8613	0.9577	0.9827 (94)
Useful gains	1447.1041	1667.3988	1836.1380	1870.6893	1649.4422	1164.9156	733.7337	753.5805	1255.3499	1495.9152	1416.1123	1350.6756 (95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Heat loss rate W	4168.5702	3797.1605	3391.7828	2669.3323	1989.2837	1234.9862	745.6071	769.0302	1428.7883	2255.3486	3138.1577	4030.1656 (97)
Space heating kWh	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98a)
Space heating requirement - total per year (kWh/year)												9239.6671
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	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9239.6671
Space heating per m2										(98c) / (4) =		39.2176 (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 %)												227.3588 (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	2024.7708	1431.1999	1157.3997	575.0230	252.8420	0.0000	0.0000	0.0000	0.0000	565.0184	1239.8727	1993.5406 (98)
Space heating efficiency (main heating system 1)	227.3588	227.3588	227.3588	227.3588	227.3588	0.0000	0.0000	0.0000	0.0000	227.3588	227.3588	227.3588 (210)
Space heating fuel (main heating system)	890.5619	629.4896	509.0631	252.9143	111.2084	0.0000	0.0000	0.0000	0.0000	248.5140	545.3375	876.8258 (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	324.9654	288.1750	308.0036	275.0900	269.6097	215.5595	213.5746	221.4693	223.2431	279.2202	292.2640	321.9663 (64)
Efficiency of water heater (217)m	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085	193.6085 (216)
Fuel for water heating, kWh/month	167.8467	148.8442	159.0858	142.0857	139.2551	111.3379	110.3126	114.3903	115.3065	144.2190	150.9562	166.2976 (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	45.0255	36.1212	32.5231	23.8278	18.4053	15.0373	16.7899	21.8242	28.3474	37.1934	42.0098	46.2769 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-261.7546	-363.3404	-562.3187	-686.0132	-672.6321	-488.4588	-481.4742	-485.9339	-493.4374	-461.9442	-292.3166	-222.8984 (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	-3.2414	-10.0587	-32.9081	-94.4033	-235.5099	-446.2432	-435.6544	-352.8817	-191.6368	-34.4522	-6.6574	-2.2703 (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												4063.9147 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												193.6085
Water heating fuel used												1669.9379 (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)												363.3819 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-7318.4400 (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												-1221.2055 (238)

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10a. Fuel costs - using BEDF prices (554)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4063.9147	26.0600	1059.0562 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.9379	26.0600	435.1858 (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	363.3819	26.0600	94.6973 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	26.0600	-1426.1394
PV Unit electricity exported	-1845.9175	5.8100	-107.2478
Total			-1533.3872 (252)
Total energy cost			55.5521 (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	4063.9147	0.1559	633.6793 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1669.9379	0.1415	236.2132 (264)
Space and water heating			869.8925 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	363.3819	0.1443	52.4472 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	0.1359	-743.7019
PV Unit electricity exported	-1845.9175	0.1087	-200.7367
Total			-944.4385 (269)
Total CO2, kg/year			-22.0987 (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	4063.9147	1.5773	6409.8234 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1669.9379	1.5231	2543.4375 (278)
Space and water heating			8953.2608 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	363.3819	1.5338	557.3673 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5472.5225	1.5024	-8221.7375
PV Unit electricity exported	-1845.9175	0.3974	-733.6420
Total			-8955.3795 (283)
Total Primary energy kWh/year			555.2486 (286)