

Full SAP Calculation Printout



Plot Reference	Finchampstead Rd - Plot 2			Issued on Date	14/12/2025
Assessment Reference	Plot 2	Plot Type Ref			
Plot Address	Plot 2, 58, Finchampstead Road, Wokingham, RG40 2NS			SAP Version	10.2
SAP Rating	81 B	DER	3.35	TER	7.32
Environmental	96 A	% DER < TER			54.23
CO ₂ Emissions (t/year)	0.97	DFEE	39.24	TFEE	40.08
Compliance Check	See BREL	% DFEE < TFEE			2.09
% DPER < TPER	11.32	DPER	34.69	TPER	39.12
Assessor Details	Mr. Steven Leahy			Assessor ID	A593-0001
Client	0864, Harding Rose Architects				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 870.0660 (5)

2. Ventilation rate

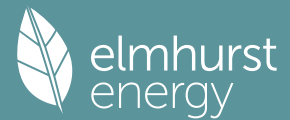
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	8 * 10 = 80.0000 (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) = 0.0919 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3419 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2907 (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	0.3706	0.3633	0.3561	0.3197	0.3125	0.2761	0.2761	0.2689	0.2907	0.3125	0.3270	0.3415 (22b)
Effective ac	0.5687	0.5660	0.5634	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5535	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			40.1400	1.3258	53.2159		(27)
Roof Windows			0.4800	1.3258	0.6364		(27a)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000 (28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000 (28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000 (29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400 (29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200 (30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000 (30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000 (30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000 (30)
Total net area of external elements A _{um} (A, m ²)			678.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	155.8639	(33)
Main dwelling							
Internal Walls			421.4400			9.0000	3792.9600 (32c)
First Floor			122.2800			18.0000	2201.0400 (32d)
Second Floor			47.8800			18.0000	861.8400 (32d)

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Ground Floor Ceiling	122.2800	9.0000	1100.5200 (32e)
First Floor Ceiling	47.8800	9.0000	430.9200 (32e)
Heat capacity Cm = Sum(A x k)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.9000	0.0380	1.3262
E4 Jamb	65.6000	0.0160	1.0496
E16 Corner (normal)	84.5000	0.0390	3.2955
E10 Eaves (insulation at ceiling level)	70.2000	0.0610	4.2822
E11 Eaves (insulation at rafter level)	36.7000	0.0100	0.3670
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0910	-4.6137
E14 Flat roof	19.0000	0.1600	3.0400
E3 Sill	33.0000	0.0210	0.6930
R1 Head of roof window	0.6000	0.2400	0.1440
R2 Sill of roof window	0.6000	0.2400	0.1440
R3 Jamb of roof window	1.6000	0.2400	0.3840
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.1118 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	165.9757 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
(38)m	Jan	Feb	Mar
Heat transfer coeff	163.2766	162.5110	161.7606
Average = Sum(39)m / 12 =	329.2523	328.4867	327.7362
HLP	Jan	Feb	Mar
HLP (average)	1.0538	1.0514	1.0490
Days in mont	31	28	31

4. Water heating energy requirements (kWh/year)			

Assumed occupancy			3.1481 (42)
Hot water usage for mixer showers			
Hot water usage for baths	105.8794	104.2883	101.9696
Hot water usage for other uses	33.2371	32.7435	32.0484
Average daily hot water use (litres/day)	46.8697	45.1654	43.4610
Daily hot water use	Jan	Feb	Mar
Energy conte	185.9863	182.1971	177.4790
Energy content (annual)	294.5568	259.4463	272.7787
Distribution loss (46)m = 0.15 x (45)m	44.1835	38.9169	40.9168
Water storage loss (or HIU loss):			
Store volume			250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):			2.0800 (48)
Temperature factor from Table 2b			0.5400 (49)
Enter (49) or (54) in (55)			1.1232 (55)
Total storage loss			
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192
Primary loss	23.2624	21.0112	23.2624
Combi loss	0.0000	0.0000	0.0000
Total heat required for water heating calculated for each month	352.6384	311.9071	330.8603
WWHRS	0.0000	0.0000	0.0000
PV diverter	0.0000	0.0000	0.0000
Solar input	0.0000	0.0000	0.0000
FGHRS	0.0000	0.0000	0.0000
Output from w/h	352.6384	311.9071	330.8603
12Total per year (kWh/year)			
Electric shower(s)	0.0000	0.0000	0.0000
Heat gains from water heating, kWh/month	144.4054	128.2345	137.1642

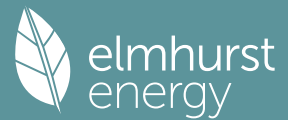
5. Internal gains (see Table 5 and 5a)			

Metabolic gains (Table 5), Watts			
(66)m	157.4051	157.4051	157.4051
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	257.4027	284.9816	257.4027
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	468.2617	473.1208	460.8761
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.7405	38.7405	38.7405
Pumps, fans	0.0000	0.0000	0.0000
Losses e.g. evaporation (negative values) (Table 5)	-125.9241	-125.9241	-125.9241
Water heating gains (Table 5)	194.0933	190.8252	184.3605
Total internal gains	989.9792	1019.1491	972.8608

6. Solar gains			

[Jan]	Area	Solar flux	g
			FF
			Access
			Gains

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	m2		Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
North	12.5400		10.6334		0.7600		0.7000		0.7700		49.1603 (74)	
Northeast	0.7800		11.2829		0.7600		0.7000		0.7700		3.2446 (75)	
South	24.7200		46.7521		0.7600		0.7000		0.7700		426.0829 (78)	
West	1.3200		19.6403		0.7600		0.7000		0.7700		9.5580 (80)	
Northwest	0.7800		11.2829		0.7600		0.7000		0.7700		3.2446 (81)	
East	0.4800		25.9287		0.7600		0.7000		1.0000		5.9590 (82)	
Solar gains	497.2494	835.5907	1123.4342	1375.7717	1538.5287	1529.6237	1473.5532	1349.6077	1209.2790	917.1425	593.2593	427.1872 (83)
Total gains	1487.2287	1854.7398	2096.2949	2316.7457	2429.2470	2388.8059	2297.7495	2173.5387	2059.4395	1794.9864	1526.3798	1394.6471 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.9529	32.0274	32.1007	32.4497	32.5158	32.8273	32.8273	32.8856	32.7066	32.5158	32.3823	32.2439
alpha	3.1302	3.1352	3.1400	3.1633	3.1677	3.1885	3.1885	3.1924	3.1804	3.1677	3.1588	3.1496
util living area	0.9878	0.9754	0.9557	0.9129	0.8343	0.7004	0.5563	0.5989	0.7884	0.9313	0.9782	0.9900 (86)
Living	19.0994	19.3443	19.6707	20.0899	20.4610	20.7330	20.8440	20.8269	20.6348	20.1411	19.5446	19.0625
Non living	17.7797	18.0926	18.5075	19.0387	19.4893	19.8001	19.9040	19.8928	19.6990	19.1109	18.3566	17.7380
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	9	0	0	0	0	0	0	0	0	0	0	0
16 / 9	22	26	0	0	0	0	0	0	0	0	0	31
MIT	20.2361	20.0110	19.6707	20.0899	20.4610	20.7330	20.8440	20.8269	20.6348	20.1411	19.5446	19.0625 (87)
Th 2	20.0387	20.0408	20.0427	20.0521	20.0538	20.0619	20.0619	20.0634	20.0588	20.0538	20.0503	20.0466 (88)
util rest of house	0.9856	0.9710	0.9476	0.8958	0.7989	0.6330	0.4571	0.5018	0.7328	0.9144	0.9737	0.9882 (89)
MIT 2	19.3311	19.1031	18.5075	19.0387	19.4893	19.8001	19.9040	19.8928	19.6990	19.1109	18.3566	19.0276 (90)
Living area fraction												0.0745 (91)
MIT	19.3985	19.1708	18.5942	19.1170	19.5617	19.8696	19.9740	19.9624	19.7687	19.1877	18.4451	19.0928 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3985	19.1708	18.5942	19.1170	19.5617	19.8696	19.9740	19.9624	19.7687	19.1877	18.4451	19.0928 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9839	0.9662	0.9313	0.8747	0.7773	0.6175	0.4471	0.4903	0.7126	0.8942	0.9629	0.9859 (94)
Useful gains	1463.2135	1792.1380	1952.3674	2026.4897	1888.1388	1474.9850	1027.2527	1065.6971	1467.6336	1605.0399	1469.7189	1375.0320 (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	4971.2281	4687.7578	3963.7112	3312.4727	2543.6753	1688.8269	1081.3112	1139.6494	1823.4293	2778.5524	3685.8602	4859.2472 (97)
Space heating kWh	2609.9629	1945.8566	1496.4398	925.9078	487.7192	0.0000	0.0000	0.0000	0.0000	873.0933	1595.6218	2592.2561 (98a)
Space heating requirement - total per year (kWh/year)												12526.8572
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	2609.9629	1945.8566	1496.4398	925.9078	487.7192	0.0000	0.0000	0.0000	0.0000	873.0933	1595.6218	2592.2561 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12526.8572
Space heating per m2										(98c) / (4) =		40.0936 (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 %)												294.6779 (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	2609.9629	1945.8566	1496.4398	925.9078	487.7192	0.0000	0.0000	0.0000	0.0000	873.0933	1595.6218	2592.2561 (98)
Space heating efficiency (main heating system 1)	294.6779	294.6779	294.6779	294.6779	294.6779	0.0000	0.0000	0.0000	0.0000	294.6779	294.6779	294.6779 (210)
Space heating fuel (main heating system)	885.7003	660.3335	507.8222	314.2101	165.5093	0.0000	0.0000	0.0000	0.0000	296.2874	541.4800	879.6915 (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	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800 (64)
Efficiency of water heater (217)m	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531 (216)
Fuel for water heating, kWh/month	219.3665	194.0287	205.8189	179.7832	173.5687	155.5912	152.7810	159.1753	161.3209	180.8904	193.6321	216.7797 (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	65.3764	52.4474	47.2230	34.5976	26.7242	21.8339	24.3787	31.6884	41.1601	54.0042	60.9976	67.1934 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4251.0343	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.7531	
Water heating fuel used												2192.7365	(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)												527.6249	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6971.3956	(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	4251.0343	0.1552	659.9469	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2192.7365	0.1410	309.2247	(264)
Space and water heating			969.1716	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	527.6249	0.1443	76.1526	(268)
Total CO2, kg/year			1045.3242	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3500	(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	4251.0343	1.5747	6694.1893	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2192.7365	1.5215	3336.1511	(278)
Space and water heating			10030.3404	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	527.6249	1.5338	809.2887	(282)
Total Primary energy kWh/year			10839.6291	(286)
Dwelling Primary energy Rate (DPER)			34.6900	(287)

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

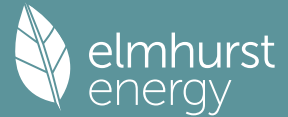
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b)	- (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c)	- (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n)	312.4400			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)... (3n)	= 870.0660	(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)
Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0460 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.2960 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2516 (21)

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Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3208	0.3145	0.3082	0.2767	0.2704	0.2390	0.2390	0.2327	0.2516	0.2704	0.2830	0.2956 (22b)
	0.5514	0.5494	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5316	0.5366	0.5401	0.5437 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Semi-glazed door			2.1000	1.0000	2.1000		(26a)
TER Opening Type			40.1400	1.1450	45.9618		(27)
TER Roof Window			0.4800	1.1450	0.6792		(27a)
Ground Floor			122.2800	0.1300	15.8964		(28a)
Above Garage			22.7700	0.1300	2.9601		(28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1800	39.4560		(29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1800	15.6708		(29a)
Slope Roof	46.0600	0.4800	45.5800	0.1100	5.0138		(30)
Flat Ceilings	35.0000		35.0000	0.1100	3.8500		(30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1100	10.3840		(30)
Dormer Roofs	7.8000		7.8000	0.1100	0.8580		(30)
Total net area of external elements Aum(A, m2)			678.7000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	144.7202	(33)

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

121.2202 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.9000	0.0500	1.7450
E4 Jamb	65.6000	0.0500	3.2800
E16 Corner (normal)	84.5000	0.0900	7.6050
E10 Eaves (insulation at ceiling level)	70.2000	0.0600	4.2120
E11 Eaves (insulation at rafter level)	36.7000	0.0400	1.4680
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0900	-4.5630
E14 Flat roof	19.0000	0.0800	1.5200
E3 Sill	33.0000	0.0500	1.6500
R1 Head of roof window	0.6000	0.0800	0.0480
R2 Sill of roof window	0.6000	0.0600	0.0360
R3 Jamb of roof window	1.6000	0.0800	0.1280

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

17.1290 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 161.8492 (37)

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

(38)m	Jan 158.3316	Feb 157.7580	Mar 157.1958	Apr 154.5551	May 154.0611	Jun 151.7611	Jul 151.7611	Aug 151.3352	Sep 152.6470	Oct 154.0611	Nov 155.0605	Dec 156.1055 (38)
Heat transfer coeff	320.1807	319.6072	319.0450	316.4043	315.9102	313.6103	313.6103	313.1844	314.4962	315.9102	316.9097	317.9546 (39)
Average = Sum(39)m / 12 =												316.4019

HLP	Jan 1.0248	Feb 1.0229	Mar 1.0211	Apr 1.0127	May 1.0111	Jun 1.0037	Jul 1.0037	Aug 1.0024	Sep 1.0066	Oct 1.0111	Nov 1.0143	Dec 1.0177 (40)
HLP (average)												1.0127
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1481 (42)
Hot water usage for mixer showers												
77.0032	75.8460	74.1597	70.9333	68.5523	65.8971	64.3878	66.0613	67.8958	70.7468	74.0425	76.7082 (42a)	
Hot water usage for baths												
33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248 (42b)	
Hot water usage for other uses												
46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697 (42c)	
Average daily hot water use (litres/day)												144.4193 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	157.1101	153.7549	149.6691	143.4567	138.4117	132.9879	130.9038	134.9720	139.2624	144.9563	151.2645	156.7027 (44)
Energy content (annual)	248.8239	218.9449	230.0359	196.3851	186.3287	163.5241	158.3168	167.1235	171.7244	196.7044	215.5040	245.3585 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2398.7742
	37.3236	32.8417	34.5054	29.4578	27.9493	24.5286	23.7475	25.0685	25.7587	29.5057	32.3256	36.8038 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)

If cylinder contains dedicated solar storage

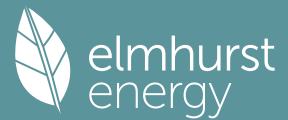
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	303.7307	268.5381	284.9427	249.5207	241.2355	216.6597	213.2236	222.0303	224.8600	251.6112	268.6396	300.2653 (62)
WWHRS	-35.2027	-31.1335	-32.6012	-26.9951	-25.1585	-21.5283	-20.1793	-21.4587	-22.2740	-26.2586	-29.7478	-34.5508 (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	268.5281	237.4046	252.3414	222.5256	216.0770	195.1315	193.0443	200.5716	202.5860	225.3526	238.8918	265.7145 (64)
12Total per year (kWh/year)												2718.1690 (64)
Electric shower(s)												2718 (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)
Total Energy used by instantaneous electric shower(s) (kWh/year) =												0.0000 (64a)

Heat gains from water heating, kWh/month											
126.6594	112.4738	120.4124	107.8065	105.8797	96.8803	96.5658	99.4940	99.6069	109.3296	114.1635	125.5071 (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	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	257.4027	284.9816	257.4027	265.9828	257.4027	265.9828	257.4027	257.4027	265.9828	257.4027	265.9828	257.4027	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	468.2617	473.1208	460.8761	434.8084	401.9027	370.9760	350.3151	345.4560	357.7007	383.7684	416.6741	447.6008	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	(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)	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	(71)
Water heating gains (Table 5)	170.2411	167.3717	161.8446	149.7313	142.3115	134.5559	129.7927	133.7285	138.3428	146.9484	158.5605	168.6924	(72)
Total internal gains	969.1271	998.6956	953.3449	923.7440	874.8384	841.7362	807.7320	806.8087	832.2479	861.3410	914.4389	946.9174	(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				12.5400	10.6334		0.6300		0.7000		0.7700		40.7513 (74)
Northeast				0.7800	11.2829		0.6300		0.7000		0.7700		2.6896 (75)
South				24.7200	46.7521		0.6300		0.7000		0.7700		353.2003 (78)
West				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (80)
Northwest				0.7800	11.2829		0.6300		0.7000		0.7700		2.6896 (81)
East				0.4800	25.9287		0.6300		0.7000		1.0000		4.9397 (82)
Solar gains	412.1936	692.6607	931.2678	1140.4423	1275.3593	1267.9775	1221.4980	1118.7537	1002.4287	760.2628	491.7807	354.1157	(83)
Total gains	1381.3207	1691.3563	1884.6127	2064.1863	2150.1978	2109.7138	2029.2300	1925.5624	1834.6766	1621.6039	1406.2196	1301.0331	(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	32.8582	32.9172	32.9752	33.2504	33.3024	33.5466	33.5466	33.5922	33.4521	33.3024	33.1974	33.0883		
alpha	3.1905	3.1945	3.1983	3.2167	3.2202	3.2364	3.2364	3.2395	3.2301	3.2202	3.2132	3.2059		
util living area	0.9901	0.9806	0.9657	0.9318	0.8660	0.7446	0.6024	0.6442	0.8233	0.9451	0.9825	0.9918	(86)	
MIT	18.6046	18.8997	19.3088	19.8488	20.3495	20.7356	20.9046	20.8786	20.6006	19.9402	19.1739	18.5558	(87)	
Th 2	20.0627	20.0643	20.0658	20.0728	20.0741	20.0802	20.0802	20.0813	20.0779	20.0741	20.0714	20.0687	(88)	
util rest of house	0.9883	0.9772	0.9592	0.9178	0.8353	0.6806	0.5019	0.5473	0.7728	0.9311	0.9788	0.9903	(89)	
MIT 2	17.2189	17.5958	18.1168	18.8006	19.4151	19.8604	20.0234	20.0043	19.7188	18.9235	17.9523	17.1600	(90)	
Living area fraction	17.3221	17.6930	18.2056	18.8787	19.4847	19.9256	20.0891	20.0694	19.7845	18.9993	18.0433	17.2640	(92)	
MIT	17.3221	17.6930	18.2056	18.8787	19.4847	19.9256	20.0891	20.0694	19.7845	18.9993	18.0433	17.2640	(93)	
Temperature adjustment												0.0000		
adjusted MIT	17.3221	17.6930	18.2056	18.8787	19.4847	19.9256	20.0891	20.0694	19.7845	18.9993	18.0433	17.2640	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9642	0.9411	0.8941	0.8115	0.6684	0.5029	0.5459	0.7536	0.9090	0.9666	0.9833	(94)
Useful gains	1353.8406	1630.7364	1773.5721	1845.6301	1744.9073	1410.1657	1020.5126	1051.1658	1382.6450	1473.9840	1359.1914	1279.2483	(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	4169.4356	4088.7244	3734.6048	3157.2966	2459.2682	1670.1621	1094.2038	1149.2000	1787.7618	2653.4231	3468.0384	4153.7614	(97)
Space heating kWh	2094.8027	1651.7679	1459.0083	944.3999	531.4845	0.0000	0.0000	0.0000	0.0000	877.5027	1518.3698	2138.6378	(98a)
Space heating requirement - total per year (kWh/year)												11215.9736	
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	2094.8027	1651.7679	1459.0083	944.3999	531.4845	0.0000	0.0000	0.0000	0.0000	877.5027	1518.3698	2138.6378	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11215.9736	
Space heating per m2										(98c) / (4) =		35.8980	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													92.3000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	2094.8027	1651.7679	1459.0083	944.3999	531.4845	0.0000	0.0000	0.0000	0.0000	877.5027	1518.3698	2138.6378	(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)	2269.5587	1789.5644	1580.7240	1023.1852	575.8229	0.0000	0.0000	0.0000	0.0000	950.7072	1645.0377	2317.0507	(211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	

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Water heating													
Water heating requirement	268.5281	237.4046	252.3414	222.5256	216.0770	195.1315	193.0443	200.5716	202.5860	225.3526	238.8918	265.7145	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.6765	87.5590	87.3474	86.9304	85.9966	79.8000	79.8000	79.8000	79.8000	86.7997	87.4591	87.7068	(217)
Fuel for water heating, kWh/month	306.2716	271.1366	288.8940	255.9813	251.2622	244.5256	241.9102	251.3428	253.8672	259.6238	273.1470	302.9577	(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	53.4832	42.9062	38.6323	28.3037	21.8626	17.8619	19.9438	25.9237	33.6723	44.1798	49.9010	54.9697	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-123.2130	-162.3832	-218.1564	-228.4477	-232.6330	-211.9593	-208.8676	-203.3856	-192.4807	-176.7834	-131.1461	-107.8589	(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	-108.5401	-222.4026	-431.8031	-634.4996	-826.1565	-825.9353	-816.6108	-697.5095	-519.2387	-313.6751	-143.3678	-86.3317	(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												12151.6507	(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												3200.9200	(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)												431.6400	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-7823.3856	(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												8046.8251	(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	12151.6507	0.2100	2551.8466	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3200.9200	0.2100	672.1932	(264)
Space and water heating			3224.0398	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	431.6400	0.1443	62.2990	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2197.3149	0.1361	-299.1264	
PV Unit electricity exported	-5626.0707	0.1265	-711.9341	
Total			-1011.0605	(269)
Total CO2, kg/year			2287.2076	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.3200	(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	12151.6507	1.1300	13731.3653	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3200.9200	1.1300	3617.0396	(278)
Space and water heating			17348.4048	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	431.6400	1.5338	662.0639	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2197.3149	1.5032	-3303.0217	
PV Unit electricity exported	-5626.0707	0.4645	-2613.4427	
Total			-5916.4644	(283)
Total Primary energy kWh/year			12224.1051	(286)
Target Primary Energy Rate (TPER)			39.1200	(287)

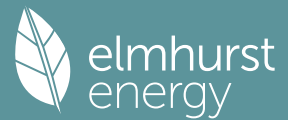
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	122.2800 (1b)	x	2.4500 (2b)	=
Ground floor			299.5860 (1b) - (3b)	

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First floor
Second floor
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 312.4400
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 870.0660 (5)

2. Ventilation rate

Number of open chimneys 0 * 80 = 0.0000 (6a)
Number of open flues 0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire 0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d)
Number of flues attached to other heater 0 * 35 = 0.0000 (6e)
Number of blocked chimneys 0 * 20 = 0.0000 (6f)
Number of intermittent extract fans 4 * 10 = 40.0000 (7a)
Number of passive vents 0 * 10 = 0.0000 (7b)
Number of flueless gas fires 0 * 40 = 0.0000 (7c)
Air changes per hour 40.0000 / (5) = 0.0460 (8)
Pressure test Yes
Pressure Test Method Blower Door
Measured/design AP50 5.0000 (17)
Infiltration rate 0.2960 (18)
Number of sides sheltered 2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2516 (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	0.3208	0.3145	0.3082	0.2767	0.2704	0.2390	0.2390	0.2327	0.2516	0.2704	0.2830	0.2956 (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	0.5514	0.5494	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5316	0.5366	0.5401	0.5437 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			40.1400	1.3258	53.2159		(27)
Roof Windows			0.4800	1.3258	0.6364		(27a)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000 (28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000 (28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000 (29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400 (29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200 (30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000 (30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000 (30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000 (30)
Total net area of external elements Aum(A, m2)			678.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	155.8639		(33)
Main dwelling							
Internal Walls			421.4400			9.0000	3792.9600 (32c)
First Floor			122.2800			18.0000	2201.0400 (32d)
Second Floor			47.8800			18.0000	861.8400 (32d)
Ground Floor Ceiling			122.2800			9.0000	1100.5200 (32e)
First Floor Ceiling			47.8800			9.0000	430.9200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 37874.0400 (34)
List of Thermal Bridges 121.2202 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.9000	0.0380	1.3262
E4 Jamb	65.6000	0.0160	1.0496
E16 Corner (normal)	84.5000	0.0390	3.2955
E10 Eaves (insulation at ceiling level)	70.2000	0.0610	4.2822
E11 Eaves (insulation at rafter level)	36.7000	0.0100	0.3670
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0910	-4.6137
E14 Flat roof	19.0000	0.1600	3.0400
E3 Sill	33.0000	0.0210	0.6930
R1 Head of roof window	0.6000	0.2400	0.1440
R2 Sill of roof window	0.6000	0.2400	0.1440
R3 Jamb of roof window	1.6000	0.2400	0.3840

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1118 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 165.9757 (37)

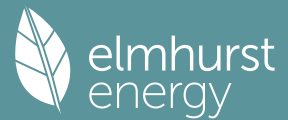
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 158.3316 Feb 157.7580 Mar 157.1958 Apr 154.5551 May 154.0611 Jun 151.7611 Jul 151.7611 Aug 151.3352 Sep 152.6470 Oct 154.0611 Nov 155.0605 Dec 156.1055 (38)
Heat transfer coeff 324.3072 323.7337 323.1715 320.5308 320.0367 317.7368 317.7368 317.3109 318.6227 320.0367 321.0362 322.0811 (39)
Average = Sum(39)m / 12 = 320.5284

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0380	1.0361	1.0343	1.0259	1.0243	1.0170	1.0170	1.0156	1.0198	1.0243	1.0275	1.0309 (40)
HLP (average)												1.0259
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.1481 (42)
Hot water usage for mixer showers

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Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248 (42b)
Average daily hot water use (litres/day)	46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697 (42c)
												73.4249 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	80.1068	77.9089	75.5094	72.5234	69.8593	67.0908	66.5160	68.9106	71.3665	74.2096	77.2220	79.9945 (44)
Distribution loss (46)m = 0.15 x (45)m	126.8697	110.9412	116.0551	99.2809	94.0441	82.4960	80.4453	85.3257	88.0021	100.7017	110.0169	125.2520 (45)
Total = Sum(45)m =												1219.4306
Water storage loss (or HIU loss):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	107.8392	94.3000	98.6469	84.3887	79.9375	70.1216	68.3785	72.5269	74.8018	85.5964	93.5143	106.4642 (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	107.8392	94.3000	98.6469	84.3887	79.9375	70.1216	68.3785	72.5269	74.8018	85.5964	93.5143	106.4642 (64)
12Total per year (kWh/year)												1036.5160 (64)
Electric shower(s)	61.6668	54.9456	59.9985	57.2558	58.3302	55.6413	57.4961	58.3302	57.2558	59.9985	58.8703	61.6668 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												701.4557 (64a)
Heat gains from water heating, kWh/month	42.3765	37.3114	39.6613	35.4111	34.5669	31.4407	31.4686	32.7143	33.0144	36.3987	38.0962	42.0327 (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	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051	157.4051 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	257.4027	284.9816	257.4027	265.9828	257.4027	265.9828	257.4027	257.4027	265.9828	257.4027	265.9828	257.4027 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	468.2617	473.1208	460.8761	434.8084	401.9027	370.9760	350.3151	345.4560	357.7007	383.7684	416.6741	447.6008 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405	38.7405 (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)	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241 (71)
Water heating gains (Table 5)	56.9576	55.5229	53.3082	49.1821	46.4609	43.6677	42.2966	43.9708	45.8533	48.9230	52.9113	56.4956 (72)
Total internal gains	852.8436	883.8468	841.8085	820.1949	775.9879	750.8480	720.2359	717.0510	739.7584	760.3156	805.7897	831.7206 (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				12.5400	10.6334		0.7600	0.7000		0.7700		49.1603 (74)
Northeast				0.7800	11.2829		0.7600	0.7000		0.7700		3.2446 (75)
South				24.7200	46.7521		0.7600	0.7000		0.7700		426.0829 (78)
West				1.3200	19.6403		0.7600	0.7000		0.7700		9.5580 (80)
Northwest				0.7800	11.2829		0.7600	0.7000		0.7700		3.2446 (81)
East				0.4800	25.9287		0.7600	0.7000		1.0000		5.9590 (82)

Solar gains	497.2494	835.5907	1123.4342	1375.7717	1538.5287	1529.6237	1473.5532	1349.6077	1209.2790	917.1425	593.2593	427.1872 (83)
Total gains	1350.0930	1719.4375	1965.2427	2195.9666	2314.5166	2280.4717	2193.7890	2066.6587	1949.0374	1677.4581	1399.0490	1258.9079 (84)

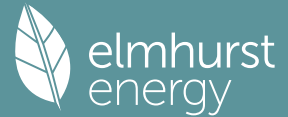
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains from living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.4401	32.4976	32.5541	32.8223	32.8730	33.1109	33.1109	33.1554	33.0189	32.8730	32.7707	32.6643
alpha	3.1627	3.1665	3.1703	3.1882	3.1915	3.2074	3.2074	3.2104	3.2013	3.1915	3.1847	3.1776
util living area	0.9907	0.9798	0.9620	0.9221	0.8470	0.7170	0.5732	0.6179	0.8057	0.9410	0.9828	0.9925 (86)
MIT	18.5553	18.8843	19.3225	19.8846	20.3884	20.7595	20.9151	20.8897	20.6212	19.9465	19.1431	18.4998 (87)
Th 2	20.0518	20.0533	20.0548	20.0618	20.0631	20.0692	20.0692	20.0704	20.0669	20.0631	20.0605	20.0577 (88)
util rest of house	0.9890	0.9762	0.9550	0.9064	0.8135	0.6507	0.4734	0.5207	0.7524	0.9261	0.9791	0.9912 (89)
MIT 2	17.7901	18.1178	18.5522	19.1067	19.5854	19.9160	20.0307	20.0169	19.8048	19.1751	18.3819	17.7389 (90)
Living area fraction	17.8471	18.1749	18.6096	19.1647	19.6452	19.9789	20.0966	20.0819	19.8656	19.2325	18.4387	17.7956 (92)
MIT	17.8471	18.1749	18.6096	19.1647	19.6452	19.9789	20.0966	20.0819	19.8656	19.2325	18.4387	17.7956 (93)
Temperature adjustment												0.0000
adjusted MIT	17.8471	18.1749	18.6096	19.1647	19.6452	19.9789	20.0966	20.0819	19.8656	19.2325	18.4387	17.7956 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9833	0.9663	0.9406	0.8877	0.7959	0.6435	0.4765	0.5220	0.7390	0.9088	0.9702	0.9864 (94)
	1327.5278	1661.4429	1848.4547	1949.3874	1842.1685	1467.5027	1045.4015	1078.8356	1440.2722	1524.5085	1357.3012	1241.7327 (95)

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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	4393.4201	4297.5308	3913.4886	3290.1388	2542.7521	1709.0659	1110.9980	1168.3190	1837.0603	2762.7311	3640.1190	4378.8729 (97)
Space heating kWh	2281.0239	1771.4511	1536.3852	965.3410	521.2341	0.0000	0.0000	0.0000	0.0000	921.2376	1643.6288	2334.0323 (98a)
Space heating requirement - total per year (kWh/year)												11974.3341
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	2281.0239	1771.4511	1536.3852	965.3410	521.2341	0.0000	0.0000	0.0000	0.0000	921.2376	1643.6288	2334.0323 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												11974.3341
Space heating per m2												(98c) / (4) = 38.3252 (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	2986.7260	2351.2524	2411.5628	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6942	0.7740	0.7413	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2073.4494	1819.9252	1787.5709	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2521.0039	2425.4270	2283.2886	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	322.2393	450.4934	368.8140	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	80.5598	112.6233	92.2035	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												285.3867 (107)
Energy for space heating												38.3252 (99)
Energy for space cooling												0.9134 (108)
Total												39.2386 (109)
Fabric Energy Efficiency (DFEE)												39.2 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	870.0660 (5)

2. Ventilation rate

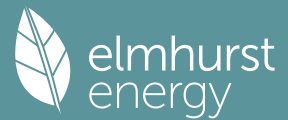
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0460 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2960 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2516 (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	0.3208	0.3145	0.3082	0.2767	0.2704	0.2390	0.2390	0.2327	0.2516	0.2704	0.2830	0.2956 (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	0.5514	0.5494	0.5475	0.5383	0.5366	0.5286	0.5286	0.5271	0.5316	0.5366	0.5401	0.5437 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							

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TER Opaque door			1.8900	1.0000	1.8900	(26)
TER Semi-glazed door			2.1000	1.0000	2.1000	(26a)
TER Opening Type			40.1400	1.1450	45.9618	(27)
TER Roof Window			0.4800	1.1450	0.6792	(27a)
Ground Floor			122.2800	0.1300	15.8964	(28a)
Above Garage			22.7700	0.1300	2.9601	(28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1800	39.4560	(29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1800	15.6708	(29a)
Slope Roof	46.0600	0.4800	45.5800	0.1100	5.0138	(30)
Flat Ceilings	35.0000		35.0000	0.1100	3.8500	(30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1100	10.3840	(30)
Dormer Roofs	7.8000		7.8000	0.1100	0.8580	(30)
Total net area of external elements Aum(A, m2)			678.7000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		144.7202	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 121.2202 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.9000	0.0500	1.7450
E4 Jamb	65.6000	0.0500	3.2800
E16 Corner (normal)	84.5000	0.0900	7.6050
E10 Eaves (insulation at ceiling level)	70.2000	0.0600	4.2120
E11 Eaves (insulation at rafter level)	36.7000	0.0400	1.4680
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0900	-4.5630
E14 Flat roof	19.0000	0.0800	1.5200
E3 Sill	33.0000	0.0500	1.6500
R1 Head of roof window	0.6000	0.0800	0.0480
R2 Sill of roof window	0.6000	0.0600	0.0360
R3 Jamb of roof window	1.6000	0.0800	0.1280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.1290 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 161.8492 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m Jan 158.3316 Feb 157.7580 Mar 157.1958 Apr 154.5551 May 154.0611 Jun 151.7611 Jul 151.7611 Aug 151.3352 Sep 152.6470 Oct 154.0611 Nov 155.0605 Dec 156.1055 (38)
Heat transfer coeff 320.1807 319.6072 319.0450 316.4043 315.9102 313.6103 313.6103 313.1844 314.4962 315.9102 316.9097 317.9546 (39)
Average = Sum(39)m / 12 = 316.4019

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0248	1.0229	1.0211	1.0127	1.0111	1.0037	1.0037	1.0024	1.0066	1.0111	1.0143	1.0177 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

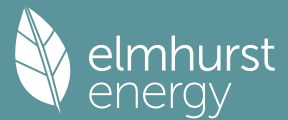
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1481 (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	33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248 (42b)
Hot water usage for other uses	46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697 (42c)
Average daily hot water use (litres/day)												73.4249 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	80.1068	77.9089	75.5094	72.5234	69.8593	67.0908	66.5160	68.9106	71.3665	74.2096	77.2220	79.9945 (44)
Energy content (annual)	126.8697	110.9412	116.0551	99.2809	94.0441	82.4960	80.4453	85.3257	88.0021	100.7017	110.0169	125.2520 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1219.4306
	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 (or HIU loss):												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	107.8392	94.3000	98.6469	84.3887	79.9375	70.1216	68.3785	72.5269	74.8018	85.5964	93.5143	106.4642 (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	107.8392	94.3000	98.6469	84.3887	79.9375	70.1216	68.3785	72.5269	74.8018	85.5964	93.5143	106.4642 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1036.5160 (64)
Electric shower(s)	61.6668	54.9456	59.9985	57.2558	58.3302	55.6413	57.4961	58.3302	57.2558	59.9985	58.8703	61.6668 (64a)
												701.4557 (64a)
Heat gains from water heating, kWh/month												
	42.3765	37.3114	39.6613	35.4111	34.5669	31.4407	31.4686	32.7143	33.0144	36.3987	38.0962	42.0327 (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													
157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 157.4051 (66)													
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
257.4027 284.9816 257.4027 265.9828 257.4027 257.4027 257.4027 257.4027 265.9828 257.4027 265.9828 257.4027 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
468.2617 473.1208 460.8761 434.8084 401.9027 370.9760 350.3151 345.4560 357.7007 383.7684 416.6741 447.6008 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 38.7405 (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)													
-125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 -125.9241 (71)													
Water heating gains (Table 5)													
56.9576 55.5229 53.3082 49.1821 46.4609 43.6677 42.2966 43.9708 45.8533 48.9230 52.9113 56.4956 (72)													
Total internal gains	852.8436 883.8468 841.8085 820.1949 775.9879 750.8480 720.2359 717.0510 739.7584 760.3156 805.7897 831.7206 (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				12.5400	10.6334		0.6300		0.7000		0.7700		40.7513 (74)
Northeast				0.7800	11.2829		0.6300		0.7000		0.7700		2.6896 (75)
South				24.7200	46.7521		0.6300		0.7000		0.7700		353.2003 (78)
West				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (80)
Northwest				0.7800	11.2829		0.6300		0.7000		0.7700		2.6896 (81)
East				0.4800	25.9287		0.6300		0.7000		1.0000		4.9397 (82)

Solar gains	412.1936	692.6607	931.2678	1140.4423	1275.3593	1267.9775	1221.4980	1118.7537	1002.4287	760.2628	491.7807	354.1157	(83)
Total gains	1265.0372	1576.5075	1773.0763	1960.6372	2051.3472	2018.8255	1941.7339	1835.8047	1742.1870	1520.5784	1297.5704	1185.8364	(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	32.8582	32.9172	32.9752	33.2504	33.3024	33.5466	33.5466	33.5922	33.4521	33.3024	33.1974	33.0883
alpha	3.1905	3.1945	3.1983	3.2167	3.2202	3.2364	3.2364	3.2395	3.2301	3.2202	3.2132	3.2059
util living area	0.9923	0.9840	0.9708	0.9397	0.8784	0.7617	0.6216	0.6648	0.8397	0.9532	0.9860	0.9937 (86)
MIT	18.5370	18.8351	19.2493	19.7999	20.3131	20.7156	20.8953	20.8665	20.5718	19.8900	19.1122	18.4882 (87)
Th 2	20.0627	20.0643	20.0658	20.0728	20.0741	20.0802	20.0802	20.0813	20.0779	20.0741	20.0714	20.0687 (88)
util rest of house	0.9909	0.9812	0.9652	0.9271	0.8496	0.6992	0.5203	0.5679	0.7918	0.9410	0.9830	0.9926 (89)
MIT 2	17.7793	18.0768	18.4888	19.0349	19.5283	19.8942	20.0310	20.0144	19.7748	19.1297	18.3590	17.7347 (90)
Living area fraction	17.8357	18.1333	18.5454	19.0919	19.5868	19.9554	20.0954	20.0779	19.8342	19.1863	18.4151	17.7909 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8357	18.1333	18.5454	19.0919	19.5868	19.9554	20.0954	20.0779	19.8342	19.1863	18.4151	17.7909 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9860	0.9728	0.9528	0.9098	0.8312	0.6895	0.5221	0.5675	0.7766	0.9254	0.9753	0.9885 (94)
Useful gains	1247.3165	1533.5537	1689.3701	1783.8698	1705.1277	1392.0752	1013.8693	1041.7987	1352.9959	1407.0876	1265.5379	1172.1522 (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	4333.8833	4229.4481	3843.0316	3224.7628	2491.5195	1679.4979	1096.2041	1151.8618	1803.3768	2712.5110	3585.8800	4321.2749 (97)
Space heating kWh	2296.4057	1811.6410	1602.3241	1037.4430	585.0755	0.0000	0.0000	0.0000	0.0000	971.2350	1670.6463	2342.9473 (98a)
Space heating requirement - total per year (kWh/year)												12317.7180
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	2296.4057	1811.6410	1602.3241	1037.4430	585.0755	0.0000	0.0000	0.0000	0.0000	971.2350	1670.6463	2342.9473 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12317.7180
Space heating per m ²										(98c) / (4) =		39.4243 (99)

8c. Space cooling requirement

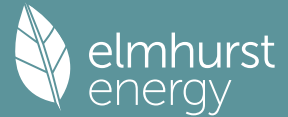
Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	2947.9370	2320.7163	2380.2014	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6461	0.7306	0.6969	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1904.7895	1695.4699	1658.8088	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2216.3386	2131.9113	2014.3800	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	224.3154	324.7124	264.5450	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	56.0788	81.1781	66.1362	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												203.3932 (107)
Energy for space heating												39.4243 (99)
Energy for space cooling												0.6510 (108)
Total												40.0753 (109)
Fabric Energy Efficiency (TFEE)												40.1 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			

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Ground floor	122.2800 (1b)	x	2.4500 (2b)	=	299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x	3.0000 (2c)	=	426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x	3.0000 (2d)	=	143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400				(4)
Dwelling volume			(3a) + (3b) + (3c) + (3d) + (3e) ... (3n)	=	870.0660 (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	8 * 10 =		80.0000 (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) = 0.0919 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				5.0000 (17)
Infiltration rate				0.3419 (18)
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =			0.2907 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.3706	0.3633	0.3561	0.3197	0.3125	0.2761	0.2761	0.2689	0.2907	0.3125	0.3270	0.3415	(22b)
	0.5687	0.5660	0.5634	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5535	0.5583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Entrance Door			2.1000	1.4000	2.9400			(26a)
Windows			40.1400	1.3258	53.2159			(27)
Roof Windows			0.4800	1.3258	0.6364			(27a)
House to Garage Door			1.8900	1.4000	2.6460			(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000	(28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000	(28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000	(29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400	(29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200	(30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000	(30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000	(30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000	(30)
Total net area of external elements Aum(A, m2)			678.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	155.8639			(33)
Main dwelling								
Internal Walls			421.4400			9.0000	3792.9600	(32c)
First Floor			122.2800			18.0000	2201.0400	(32d)
Second Floor			47.8800			18.0000	861.8400	(32d)
Ground Floor Ceiling			122.2800			9.0000	1100.5200	(32e)
First Floor Ceiling			47.8800			9.0000	430.9200	(32e)

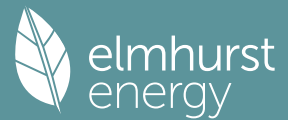
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =			37874.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				121.2202 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	34.9000	0.0380	1.3262	
E4 Jamb	65.6000	0.0160	1.0496	
E16 Corner (normal)	84.5000	0.0390	3.2955	
E10 Eaves (insulation at ceiling level)	70.2000	0.0610	4.2822	
E11 Eaves (insulation at rafter level)	36.7000	0.0100	0.3670	
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0910	-4.6137	
E14 Flat roof	19.0000	0.1600	3.0400	
E3 Sill	33.0000	0.0210	0.6930	
R1 Head of roof window	0.6000	0.2400	0.1440	
R2 Sill of roof window	0.6000	0.2400	0.1440	
R3 Jamb of roof window	1.6000	0.2400	0.3840	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				10.1118 (36)
Point Thermal bridges	(36a) =			0.0000
Total fabric heat loss	(33) + (36) + (36a) =			165.9757 (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	163.2766	162.5110	161.7606	158.2359	157.5764	154.5065	154.5065	153.9380	155.6890	157.5764	158.9105	160.3052	(38)
Average = Sum(39)m / 12 =	329.2523	328.4867	327.7362	324.2115	323.5521	320.4821	320.4821	319.9136	321.6646	323.5521	324.8862	326.2809	(39)
												324.2084	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0538	1.0514	1.0490	1.0377	1.0356	1.0257	1.0257	1.0239	1.0295	1.0356	1.0398	1.0443	(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	3.1481 (42)											
Hot water usage for mixer showers												
	105.8794	104.2883	101.9696	97.5333	94.2595	90.6085	88.5333	90.8344	93.3568	97.2768	101.8084	105.4738 (42a)

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Hot water usage for baths	33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248 (42b)
Hot water usage for other uses	46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697 (42c)
Average daily hot water use (litres/day)												171.0422 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	185.9863	182.1971	177.4790	170.0567	164.1188	157.6993	155.0493	159.7450	164.7233	171.4864	179.0304	185.4682 (44)
Distribution loss (46)m = 0.15 x (45)m	294.5568	259.4463	272.7787	232.7991	220.9354	193.9097	187.5187	197.7976	203.1203	232.7054	255.0616	290.3984 (45)
Water storage loss (or HIU loss):	44.1835	38.9169	40.9168	34.9199	33.1403	29.0865	28.1278	29.6696	30.4680	34.9058	38.2592	43.5598 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1232 (55)
Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800 (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	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800 (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	144.4054	128.2345	137.1642	122.3721	119.9263	109.4414	108.8152	112.2330	112.5039	123.8398	129.7744	143.0228 (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	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6908	66.3397	53.9511	40.8444	30.5317	25.7761	27.8520	36.2031	48.5917	61.6984	72.0111	76.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	698.8981	706.1505	687.8747	648.9678	599.8548	553.6955	522.8583	515.6059	533.8817	572.7886	621.9016	668.0609 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367 (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)	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241 (71)
Water heating gains (Table 5)	194.0933	190.8252	184.3605	169.9613	161.1913	152.0019	146.2570	150.8508	156.2554	166.4514	180.2422	192.2349 (72)
Total internal gains	1087.6809	1083.3141	1046.1850	979.7723	911.5765	851.4723	816.9661	822.6586	858.7276	920.9371	994.1536	1057.0612 (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					12.5400	10.6334		0.7600	0.7000	0.7700		49.1603 (74)	
Northeast					0.7800	11.2829		0.7600	0.7000	0.7700		3.2446 (75)	
South					24.7200	46.7521		0.7600	0.7000	0.7700		426.0829 (78)	
West					1.3200	19.6403		0.7600	0.7000	0.7700		9.5580 (80)	
Northwest					0.7800	11.2829		0.7600	0.7000	0.7700		3.2446 (81)	
East					0.4800	25.9287		0.7600	0.7000	1.0000		5.9590 (82)	
Solar gains	497.2494	835.5907	1123.4342	1375.7717	1538.5287	1529.6237	1473.5532	1349.6077	1209.2790	917.1425	593.2593	427.1872 (83)	
Total gains	1584.9303	1918.9048	2169.6192	2355.5439	2450.1053	2381.0960	2290.5193	2172.2663	2068.0066	1838.0796	1587.4129	1484.2484 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	31.9529	32.0274	32.1007	32.4497	32.5158	32.8273	32.8273	32.8856	32.7066	32.5158	32.3823	32.2439
util living area	3.1302	3.1352	3.1400	3.1633	3.1677	3.1885	3.1885	3.1924	3.1804	3.1677	3.1588	3.1496
	0.9854	0.9731	0.9518	0.9096	0.8316	0.7017	0.5576	0.5991	0.7870	0.9273	0.9758	0.9880 (86)
Living	19.1409	19.3703	19.6983	20.1024	20.4659	20.7320	20.8436	20.8268	20.6364	20.1559	19.5697	19.1010
Non living	17.8324	18.1254	18.5418	19.0536	19.4947	19.7992	19.9037	19.8927	19.7007	19.1287	18.3882	17.7871
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	9	0	0	0	0	0	0	0	0	0	0	0
16 / 9	22	26	0	0	0	0	0	0	0	0	0	31
MIT	20.2527	20.0265	19.6983	20.1024	20.4659	20.7320	20.8436	20.8268	20.6364	20.1559	19.5697	19.9245 (87)
Th 2	20.0387	20.0408	20.0427	20.0521	20.0538	20.0619	20.0619	20.0634	20.0588	20.0538	20.0503	20.0466 (88)
util rest of house	0.9828	0.9684	0.9430	0.8920	0.7960	0.6344	0.4584	0.5021	0.7311	0.9097	0.9708	0.9859 (89)
MIT 2	19.3476	19.1189	18.5418	19.0536	19.4947	19.7992	19.9037	19.8927	19.7007	19.1287	18.3882	19.0493 (90)
Living area fraction									fLA = Living area / (4) =			0.0745 (91)
MIT	19.4151	19.1866	18.6280	19.1317	19.5671	19.8687	19.9737	19.9623	19.7704	19.2052	18.4762	19.1145 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4151	19.1866	18.6280	19.1317	19.5671	19.8687	19.9737	19.9623	19.7704	19.2052	18.4762	19.1145 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9633	0.9261	0.8708	0.7744	0.6188	0.4483	0.4905	0.7111	0.8892	0.9593	0.9834	(94)
Useful gains	1554.6001	1848.4446	2009.3229	2051.1485	1897.2579	1473.3832	1026.7544	1065.5768	1470.4696	1634.3576	1522.7504	1459.5641	(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	4976.6751	4692.9434	3974.7767	3317.2491	2545.4102	1688.5364	1081.2221	1139.6279	1823.9601	2784.2348	3695.9815	4866.3165	(97)
Space heating kWh	2546.0238	1911.5032	1462.2976	911.5925	482.2254	0.0000	0.0000	0.0000	0.0000	855.5087	1564.7264	2534.6238	(98a)
Space heating requirement - total per year (kWh/year)												12268.5013	
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	2546.0238	1911.5032	1462.2976	911.5925	482.2254	0.0000	0.0000	0.0000	0.0000	855.5087	1564.7264	2534.6238	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12268.5013	
Space heating per m2											(98c) / (4) =	39.2667	(99)

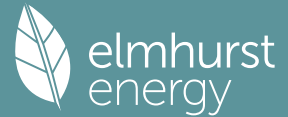
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												294.6779	(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	2546.0238	1911.5032	1462.2976	911.5925	482.2254	0.0000	0.0000	0.0000	0.0000	855.5087	1564.7264	2534.6238	(98)
Space heating efficiency (main heating system 1)	294.6779	294.6779	294.6779	294.6779	294.6779	0.0000	0.0000	0.0000	0.0000	294.6779	294.6779	294.6779	(210)
Space heating fuel (main heating system)	864.0024	648.6755	496.2360	309.3522	163.6449	0.0000	0.0000	0.0000	0.0000	290.3200	530.9956	860.1338	(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	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800	(64)
Efficiency of water heater (217)m	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	(216)
Fuel for water heating, kWh/month	219.3665	194.0287	205.8189	179.7832	173.5687	155.5912	152.7810	159.1753	161.3209	180.8904	193.6321	216.7797	(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	65.3764	52.4474	47.2230	34.5976	26.7242	21.8339	24.3787	31.6884	41.1601	54.0042	60.9976	67.1934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4163.3602	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.7531	
Water heating fuel used												2192.7365	(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)												527.6249	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6883.7216	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4163.3602	16.4900	686.5381	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2192.7365	16.4900	361.5822	(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	527.6249	16.4900	87.0053	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1135.1257	(255)

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11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] = 1.1433 (257)$
SAP value	81.4678
SAP rating (Section 12)	81 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4163.3602	0.1552	646.2487 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2192.7365	0.1410	309.2247 (264)
Space and water heating			955.4734 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	527.6249	0.1443	76.1526 (268)
Total CO ₂ , kg/year			1031.6260 (272)
CO ₂ emissions per m ²			3.3000 (273)
EI value			96.1326
EI rating			96 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	870.0660 (5)

2. Ventilation rate

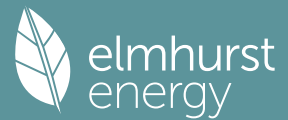
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	8 * 10 = 80.0000 (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) = 0.0919 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3419 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2907 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.9000	3.5000	3.6000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.8750	0.9000	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Adj infilt rate	0.2979	0.2761	0.2834	0.2543	0.2616	0.2325	0.2398	0.2253	0.2253	0.2471	0.2398	0.2689 (22b)
Effective ac	0.5444	0.5381	0.5402	0.5323	0.5342	0.5270	0.5287	0.5254	0.5254	0.5305	0.5287	0.5361 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			40.1400	1.3258	53.2159		(27)
Roof Windows			0.4800	1.3258	0.6364		(27a)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000 (28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000 (28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000 (29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400 (29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200 (30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000 (30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000 (30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000 (30)

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Total net area of external elements Aum(A, m2)	678.7000			(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	155.8639		(33)
Main dwelling				
Internal Walls	421.4400	9.0000	3792.9600	(32c)
First Floor	122.2800	18.0000	2201.0400	(32d)
Second Floor	47.8800	18.0000	861.8400	(32d)
Ground Floor Ceiling	122.2800	9.0000	1100.5200	(32e)
First Floor Ceiling	47.8800	9.0000	430.9200	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 37874.0400 (34)
121.2202 (35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	34.9000	0.0380	1.3262	
E4 Jamb	65.6000	0.0160	1.0496	
E16 Corner (normal)	84.5000	0.0390	3.2955	
E10 Eaves (insulation at ceiling level)	70.2000	0.0610	4.2822	
E11 Eaves (insulation at rafter level)	36.7000	0.0100	0.3670	
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0910	-4.6137	
E14 Flat roof	19.0000	0.1600	3.0400	
E3 Sill	33.0000	0.0210	0.6930	
R1 Head of roof window	0.6000	0.2400	0.1440	
R2 Sill of roof window	0.6000	0.2400	0.1440	
R3 Jamb of roof window	1.6000	0.2400	0.3840	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
Total fabric heat loss
(33) + (36) + (36a) = 165.9757 (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	156.3029	154.5065	155.0901	152.8464	153.3846	151.3229	151.8156	150.8453	150.8453	152.3234	151.8156	153.9380 (38)
Heat transfer coeff	322.2786	320.4821	321.0658	318.8221	319.3603	317.2985	317.7912	316.8210	316.8210	318.2991	317.7912	319.9136 (39)
Average = Sum(39)m / 12 =												318.8954
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0315	1.0257	1.0276	1.0204	1.0221	1.0156	1.0171	1.0140	1.0140	1.0188	1.0171	1.0239 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

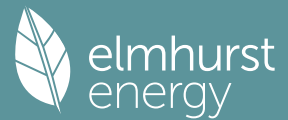
4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1481 (42)
Hot water usage for mixer showers												
105.8794	104.2883	101.9696	97.5333	94.2595	90.6085	88.5333	90.8344	93.3568	97.2768	101.8084	105.4738	(42a)
Hot water usage for baths												
33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248	(42b)
Hot water usage for other uses												
46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697	(42c)
Average daily hot water use (litres/day)												171.0422 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
185.9863	182.1971	177.4790	170.0567	164.1188	157.6993	155.0493	159.7450	164.7233	171.4864	179.0304	185.4682	(44)
Energy conte	294.5568	259.4463	272.7787	232.7991	220.9354	193.9097	187.5187	197.7976	203.1203	232.7054	255.0616	290.3984 (45)
Energy content (annual)										Total = Sum(45)m =		2841.0281
Distribution loss (46)m = 0.15 x (45)m												
44.1835	38.9169	40.9168	34.9199	33.1403	29.0865	28.1278	29.6696	30.4680	34.9058	38.2592	43.5598	(46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1232 (55)
Total storage loss												
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(56)
If cylinder contains dedicated solar storage												
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800	(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	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month												
144.4054	128.2345	137.1642	122.3721	119.9263	109.4414	108.8152	112.2330	112.5039	123.8398	129.7744	143.0228	(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	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
74.6908	66.3397	53.9511	40.8444	30.5317	25.7761	27.8520	36.2031	48.5917	61.6984	72.0111	76.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
698.8981	706.1505	687.8747	648.9678	599.8548	553.6955	522.8583	515.6059	533.8817	572.7886	621.9016	668.0609	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	(71)
Water heating gains (Table 5)												
194.0933	190.8252	184.3605	169.9613	161.1913	152.0019	146.2570	150.8508	156.2554	166.4514	180.2422	192.2349	(72)
Total internal gains	1087.6809	1083.3141	1046.1850	979.7723	911.5765	851.4723	816.9661	822.6586	858.7276	920.9371	994.1536	1057.0612 (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	12.5400		12.7500		0.7600		0.7000		0.7700		58.9457 (74)	
Northeast	0.7800		13.7758		0.7600		0.7000		0.7700		3.9615 (75)	
South	24.7200		54.0600		0.7600		0.7000		0.7700		492.6851 (78)	
West	1.3200		23.7835		0.7600		0.7000		0.7700		11.5743 (80)	
Northwest	0.7800		13.7758		0.7600		0.7000		0.7700		3.9615 (81)	
East	0.4800		31.5802		0.7600		0.7000		1.0000		7.2579 (82)	
Solar gains	578.3859	863.7207	1136.5791	1424.3347	1564.3640	1643.7046	1580.1545	1475.2023	1307.6612	1000.8226	679.6298	499.9294 (83)
Total gains	1666.0668	1947.0348	2182.7641	2404.1070	2475.9406	2495.1769	2397.1206	2297.8609	2166.3888	1921.7597	1673.7835	1556.9906 (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	32.6443	32.8273	32.7676	32.9982	32.9426	33.1567	33.1053	33.2067	33.2067	33.0525	33.1053	32.8856
alpha	3.1763	3.1885	3.1845	3.1999	3.1962	3.2104	3.2070	3.2138	3.2138	3.2035	3.2070	3.1924
util living area	0.9818	0.9697	0.9458	0.8945	0.7996	0.6367	0.4744	0.5117	0.7490	0.9085	0.9696	0.9851 (86)
Living	19.2881	19.4848	19.8072	20.2042	20.5573	20.7903	20.8723	20.8629	20.6921	20.2684	19.6970	19.2415
Non living	18.0330	18.2858	18.6918	19.1892	19.6094	19.8628	19.9310	19.9277	19.7697	19.2766	18.5628	17.9782
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	8	0	0	0	0	0	0	0	0	0	0	0
16 / 9	23	22	0	0	0	0	0	0	0	0	0	31
MIT	20.2806	20.0011	19.8072	20.2042	20.5573	20.7903	20.8723	20.8629	20.6921	20.2684	19.6970	20.0040 (87)
Th 2	20.0572	20.0619	20.0604	20.0663	20.0649	20.0704	20.0691	20.0717	20.0717	20.0677	20.0691	20.0634 (88)
util rest of house	0.9785	0.9644	0.9359	0.8740	0.7573	0.5609	0.3696	0.4077	0.6872	0.8865	0.9634	0.9824 (89)
MIT 2	19.3943	19.0654	18.6918	19.1892	19.6094	19.8628	19.9310	19.9277	19.7697	19.2766	18.5628	19.1430 (90)
Living area fraction									fLA = Living area / (4) =			0.0745 (91)
MIT	19.4603	19.1351	18.7749	19.2649	19.6800	19.9319	20.0011	19.9974	19.8385	19.3505	18.6473	19.2072 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4603	19.1351	18.7749	19.2649	19.6800	19.9319	20.0011	19.9974	19.8385	19.3505	18.6473	19.2072 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9761	0.9580	0.9183	0.8526	0.7372	0.5485	0.3615	0.3987	0.6694	0.8650	0.9502	0.9795 (94)
Useful gains	1626.1993	1865.2472	2004.4139	2049.6773	1825.2584	1368.7199	866.4672	916.2705	1450.0898	1662.4100	1590.4867	1524.9992 (95)
Ext temp.	4.8000	5.3000	7.0000	9.4000	12.4000	15.2000	17.2000	17.0000	14.4000	11.1000	7.5000	4.7000 (96)
Heat loss rate W	4724.7127	4433.9079	3780.5319	3145.1360	2324.9462	1501.4310	890.1791	949.6337	1723.0184	2626.1253	3542.5162	4641.0499 (97)
Space heating kWh	2305.2939	1726.1400	1321.4318	788.7303	371.7677	0.0000	0.0000	0.0000	0.0000	717.0042	1405.4613	2318.3417 (98a)
Space heating requirement - total per year (kWh/year)												10954.1709
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	2305.2939	1726.1400	1321.4318	788.7303	371.7677	0.0000	0.0000	0.0000	0.0000	717.0042	1405.4613	2318.3417 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10954.1709
Space heating per m2										(98c) / (4) =		35.0601 (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 %)												293.1275 (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	2305.2939	1726.1400	1321.4318	788.7303	371.7677	0.0000	0.0000	0.0000	0.0000	717.0042	1405.4613	2318.3417 (98)
Space heating efficiency (main heating system 1)	293.1275	293.1275	293.1275	293.1275	293.1275	0.0000	0.0000	0.0000	0.0000	293.1275	293.1275	293.1275 (210)
Space heating fuel (main heating system)	786.4476	588.8701	450.8045	269.0742	126.8280	0.0000	0.0000	0.0000	0.0000	244.6049	479.4710	790.8989 (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	352.6384	311.9071	330.8603	289.0071	279.0170	250.1177	245.6003	255.8792	259.3283	290.7870	311.2696	348.4800 (64)
Efficiency of water heater												160.8910 (216)
(217)m	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910 (217)
Fuel for water heating, kWh/month	219.1785	193.8624	205.6425	179.6292	173.4199	155.4579	152.6501	159.0389	161.1826	180.7354	193.4661	216.5939 (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	65.3764	52.4474	47.2230	34.5976	26.7242	21.8339	24.3787	31.6884	41.1601	54.0042	60.9976	67.1934 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

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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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3736.9992	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.8910	
Water heating fuel used												2190.8573	(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)												527.6249	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												6455.4814	(238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3736.9992	28.4300	1062.4289	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2190.8573	28.4300	622.8607	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	527.6249	28.4300	150.0038	(250)
Additional standing charges			0.0000	(251)
Total energy cost			1835.2934	(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	3736.9992	0.1555	581.1851	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2190.8573	0.1410	308.9597	(264)
Space and water heating			890.1448	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	527.6249	0.1443	76.1526	(268)
Total CO2, kg/year			966.2974	(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	3736.9992	1.5758	5888.6007	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2190.8573	1.5215	3333.2920	(278)
Space and water heating			9221.8927	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	527.6249	1.5338	809.2887	(282)
Total Primary energy kWh/year			10031.1814	(286)

SAP 10 EPC IMPROVEMENTS

Plot 2

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

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 118	-52 kg (5.4%)
U Solar photovoltaic panels	+ 2.9	-£ 319	-150 kg (16.4%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£118	0.17 kg/m ²	B 82 A 96
Solar photovoltaic panels	£319	0.48 kg/m ²	B 85 A 97
Total Savings	£437	0.65 kg/m ²	

Potential energy efficiency rating:	B 85
Potential environmental impact rating:	A 97

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Fuel prices for cost data on this page from database revision number 587 TEST (28 Nov 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £1835	Potential £1717	Saving £118
Electricity			
Space heating	£1062	£1086	-£23
Water heating	£623	£481	£142
Lighting	£150	£150	£0
Generated (PV)	-£0	-£319	£319
Total cost of fuels	£1835	£1398	£437
Total cost of uses	£1835	£1398	£438
Delivered energy	21 kWh/m²	16 kWh/m²	5 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	32 kWh/m²	25 kWh/m²	7 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)
Main dwelling			
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 870.0660 (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	8 * 10 = 80.0000 (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) = 0.0919 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3419 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2907 (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	0.3706	0.3633	0.3561	0.3197	0.3125	0.2761	0.2761	0.2689	0.2907	0.3125	0.3270	0.3415 (22b)
Effective ac	0.5687	0.5660	0.5634	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5535	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			40.1400	1.3258	53.2159		(27)
Roof Windows			0.4800	1.3258	0.6364		(27a)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000 (28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000 (28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000 (29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400 (29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200 (30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000 (30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000 (30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000 (30)
Total net area of external elements Aum(A, m²)			678.7000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	155.8639			(33)
Main dwelling							
Internal Walls			421.4400			9.0000	3792.9600 (32c)
First Floor			122.2800			18.0000	2201.0400 (32d)
Second Floor			47.8800			18.0000	861.8400 (32d)
Ground Floor Ceiling			122.2800			9.0000	1100.5200 (32e)
First Floor Ceiling			47.8800			9.0000	430.9200 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	37874.0400			(34)

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

121.2202 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	34.9000	0.0380	1.3262
E2 Other lintels (including other steel lintels)	65.6000	0.0160	1.0496
E4 Jamb	84.5000	0.0390	3.2955
E16 Corner (normal)	70.2000	0.0610	4.2822
E10 Eaves (insulation at ceiling level)	36.7000	0.0100	0.3670
E11 Eaves (insulation at rafter level)	50.7000	-0.0910	-4.6137
E17 Corner (inverted - internal area greater than external area)	19.0000	0.1600	3.0400
E14 Flat roof	33.0000	0.0210	0.6930
E3 Sill	0.6000	0.2400	0.1440
R1 Head of roof window	0.6000	0.2400	0.1440
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window			

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

10.1118 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 165.9757 (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	163.2766	162.5110	161.7606	158.2359	157.5764	154.5065	154.5065	153.9380	155.6890	157.5764	158.9105	160.3052 (38)
Heat transfer coeff	329.2523	328.4867	327.7362	324.2115	323.5521	320.4821	320.4821	319.9136	321.6646	323.5521	324.8862	326.2809 (39)
Average = Sum(39)m / 12 =												324.2084

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0538	1.0514	1.0490	1.0377	1.0356	1.0257	1.0257	1.0239	1.0295	1.0356	1.0398	1.0443 (40)
HLP (average)												1.0377
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

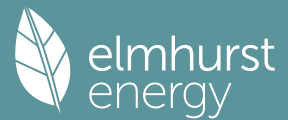
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.1481 (42)
Hot water usage for mixer showers													
105.8794	104.2883	101.9696	97.5333	94.2595	90.6085	88.5333	90.8344	93.3568	97.2768	101.8084	105.4738	105.4738	(42a)
Hot water usage for baths													
33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248	33.1248	(42b)
Hot water usage for other uses													
46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697	46.8697	(42c)
Average daily hot water use (litres/day)													171.0422 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	185.9863	182.1971	177.4790	170.0567	164.1188	157.6993	155.0493	159.7450	164.7233	171.4864	179.0304	185.4682	(44)
Energy content (annual)	294.5568	259.4463	272.7787	232.7991	220.9354	193.9097	187.5187	197.7976	203.1203	232.7054	255.0616	290.3984	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2841.0281	
44.1835	38.9169	40.9168	34.9199	33.1403	29.0865	28.1278	29.6696	30.4680	34.9058	38.2592	43.5598	43.5598	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0800 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1232 (55)
Total storage loss													
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	(56)
If cylinder contains dedicated solar storage													
34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
352.6384	311.9071	329.4645	282.2535	266.2227	237.5110	232.5733	243.7828	253.9254	289.3913	311.2696	348.4800	348.4800	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.8000 (H2)
Collector linear heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0000 (H4)
Collector loop efficiency													0.9000 (H5)
Incidence angle modifier													1.0000 (H6)
Overshading factor													0.8000 (H8)
Overall heat loss coefficient of system													6.5000 (H10)
Heat loss coefficient of collector loop													3.9667 (H11)
Dedicated solar storage volume													75.0000 (H12)
Effective solar volume													75.0000 (H14)
Reference volume													225.0000 (H15)
Storage tank correction coefficient													1.3161 (H16)
Heat delivered to hot water													655.8950 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													655.8950
Solar input	-0.0000	-16.1611	-60.0360	-83.9935	-111.7944	-103.4048	-102.8268	-88.7659	-59.9875	-28.9251	-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													
352.6384	295.7460	269.4285	198.2601	154.4284	134.1062	129.7465	155.0169	193.9379	260.4662	311.2696	348.4800	348.4800	(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													
144.4054	128.2345	136.0476	116.9692	109.6909	99.3560	98.3937	102.5558	108.1816	122.7232	129.7744	143.0228	143.0228	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
74.6908	66.3397	53.9511	40.8444	30.5317	25.7761							
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
698.8981	706.1505	687.8747	648.9678	599.8548	553.6955	522.8583	515.6059	533.8817	572.7886	621.9016	668.0609	668.0609 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367 (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)												
-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241 (71)
Water heating gains (Table 5)												

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Total internal gains	194.0933	190.8252	182.8597	162.4573	147.4340	137.9944	132.2496	137.8439	150.2522	164.9506	180.2422	192.2349 (72)
	1087.6809	1083.3141	1044.6842	972.2683	897.8192	837.4649	802.9586	809.6517	852.7244	919.4363	994.1536	1057.0612 (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					12.5400	10.6334		0.7600	0.7000	0.7700		49.1603 (74)
Northeast					0.7800	11.2829		0.7600	0.7000	0.7700		3.2446 (75)
South					24.7200	46.7521		0.7600	0.7000	0.7700		426.0829 (78)
West					1.3200	19.6403		0.7600	0.7000	0.7700		9.5580 (80)
Northwest					0.7800	11.2829		0.7600	0.7000	0.7700		3.2446 (81)
East					0.4800	25.9287		0.7600	0.7000	1.0000		5.9590 (82)

Solar gains	497.2494	835.5907	1123.4342	1375.7717	1538.5287	1529.6237	1473.5532	1349.6077	1209.2790	917.1425	593.2593	427.1872 (83)
Total gains	1584.9303	1918.9048	2168.1184	2348.0399	2436.3479	2367.0885	2276.5118	2159.2593	2062.0034	1836.5788	1587.4129	1484.2484 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.9529	32.0274	32.1007	32.4497	32.5158	32.8273	32.8273	32.8856	32.7066	32.5158	32.3823	32.2439
alpha	3.1302	3.1352	3.1400	3.1633	3.1677	3.1885	3.1885	3.1924	3.1804	3.1677	3.1588	3.1496
util living area	0.9854	0.9731	0.9519	0.9102	0.8334	0.7042	0.5603	0.6017	0.7880	0.9275	0.9758	0.9880 (86)
Living	19.1409	19.3703	19.6977	20.1000	20.4626	20.7302	20.8428	20.8259	20.6353	20.1554	19.5697	19.1010
Non living	17.8324	18.1254	18.5411	19.0507	19.4912	19.7976	19.9032	19.8920	19.6995	19.1281	18.3882	17.7871
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	9	0	0	0	0	0	0	0	0	0	0	0
16 / 9	22	26	0	0	0	0	0	0	0	0	0	31
MIT	20.2527	20.0265	19.6977	20.1000	20.4626	20.7302	20.8428	20.8259	20.6353	20.1554	19.5697	19.9245 (87)
Th 2	20.0387	20.0408	20.0427	20.0521	20.0538	20.0619	20.0619	20.0634	20.0588	20.0538	20.0503	20.0466 (88)
util rest of house	0.9828	0.9684	0.9431	0.8927	0.7979	0.6369	0.4608	0.5045	0.7323	0.9098	0.9708	0.9859 (89)
MIT 2	19.3476	19.1189	18.5411	19.0507	19.4912	19.7976	19.9032	19.8920	19.6995	19.1281	18.3882	19.0493 (90)
Living area fraction										FLA = Living area / (4) =		0.0745 (91)
MIT	19.4151	19.1866	18.6273	19.1289	19.5636	19.8671	19.9732	19.9616	19.7692	19.2046	18.4762	19.1145 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4151	19.1866	18.6273	19.1289	19.5636	19.8671	19.9732	19.9616	19.7692	19.2046	18.4762	19.1145 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9809	0.9633	0.9262	0.8715	0.7763	0.6212	0.4506	0.4929	0.7122	0.8893	0.9593	0.9834 (94)
Useful gains	1554.6001	1848.4446	2008.1676	2046.4068	1891.2555	1470.4436	1025.7754	1064.3348	1468.4845	1633.3454	1522.7504	1459.5641 (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	4976.6751	4692.9434	3974.5521	3316.3308	2544.2684	1688.0028	1081.0471	1139.4053	1823.5886	2784.0386	3695.9815	4866.3165 (97)
Space heating kWh	2546.0238	1911.5032	1462.9901	914.3453	485.8416	0.0000	0.0000	0.0000	0.0000	856.1158	1564.7264	2534.6238 (98a)
Space heating requirement - total per year (kWh/year)												12276.1700
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	2546.0238	1911.5032	1462.9901	914.3453	485.8416	0.0000	0.0000	0.0000	0.0000	856.1158	1564.7264	2534.6238 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												12276.1700
Space heating per m2										(98c) / (4) =		39.2913 (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 %)												294.6779 (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	2546.0238	1911.5032	1462.9901	914.3453	485.8416	0.0000	0.0000	0.0000	0.0000	856.1158	1564.7264	2534.6238 (98)
Space heating efficiency (main heating system 1)	294.6779	294.6779	294.6779	294.6779	294.6779	0.0000	0.0000	0.0000	0.0000	294.6779	294.6779	294.6779 (210)
Space heating fuel (main heating system)	864.0024	648.6755	496.4710	310.2864	164.8721	0.0000	0.0000	0.0000	0.0000	290.5260	530.9956	860.1338 (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	352.6384	295.7460	269.4285	198.2601	154.4284	134.1062	129.7465	155.0169	193.9379	260.4662	311.2696	348.4800 (64)
Efficiency of water heater (217)m	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531	160.7531 (216)
Fuel for water heating, kWh/month	219.3665	183.9753	167.6039	123.3320	96.0656	83.4237	80.7117	96.4317	120.6433	162.0287	193.6321	216.7797 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	65.3764	52.4474	47.2230	34.5976	26.7242	21.8339	24.3787	31.6884	41.1601	54.0042	60.9976	67.1934 (232)

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Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-42.2614	-65.4296	-101.4626	-121.6805	-133.9916	-118.1407	-116.4261	-107.5420	-92.1022	-76.4512	-47.8781	-35.8453	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1												4165.9626	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												160.7531		
Water heating fuel used												1743.9940	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
pump for solar water heating												80.0000	(230g)	
Total electricity for the above, kWh/year												80.0000	(231)	
Electricity for lighting (calculated in Appendix L)												527.6249	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation												-1059.2114	(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												5458.3702	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4165.9626	16.4900	686.9672	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1743.9940	16.4900	287.5846	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	527.6249	16.4900	87.0053	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1059.2114	16.4900	-174.6640	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-174.6640	(252)
Total energy cost			900.0852	(255)

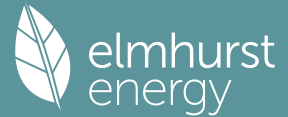
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9065	(257)
SAP value		85.3051	
SAP rating (Section 12)		85	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4165.9626	0.1552	646.6083	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1743.9940	0.1446	252.2514	(264)
Space and water heating			898.8597	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	527.6249	0.1443	76.1526	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1059.2114	0.1339	-141.8194	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-141.8194	(269)
Total CO2, kg/year			844.2898	(272)
CO2 emissions per m2			2.7000	(273)
EI value			96.8349	
EI rating			97	(274)
EI band			A	

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	122.2800 (1b)	x 2.4500 (2b)	= 299.5860 (1b) - (3b)
First floor	142.2800 (1c)	x 3.0000 (2c)	= 426.8400 (1c) - (3c)
Second floor	47.8800 (1d)	x 3.0000 (2d)	= 143.6400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	312.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 870.0660 (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	8 * 10 = 80.0000 (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) = 0.0919 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3419 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2907 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.9000	3.5000	3.6000	3.2000	3.3000	3.1000	3.1000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.8750	0.9000	0.8000	0.8250	0.7750	0.7750	0.8500	0.8250	0.9250 (22a)
Adj infilt rate	0.2979	0.2761	0.2834	0.2543	0.2616	0.2325	0.2398	0.2253	0.2253	0.2471	0.2398	0.2689 (22b)
Effective ac	0.5444	0.5381	0.5402	0.5323	0.5342	0.5270	0.5287	0.5254	0.5254	0.5305	0.5287	0.5361 (25)

3. Heat losses and heat loss parameter

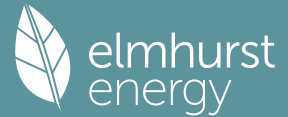
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Entrance Door			2.1000	1.4000	2.9400		(26a)
Windows			40.1400	1.3258	53.2159		(27)
Roof Windows			0.4800	1.3258	0.6364		(27a)
House to Garage Door			1.8900	1.4000	2.6460		(26)
Ground Floor			122.2800	0.1200	14.6736	110.0000	13450.8000 (28a)
Above Garage			22.7700	0.1800	4.0986	20.0000	455.4000 (28b)
Cavity Wall	257.3300	38.1300	219.2000	0.1700	37.2640	60.0000	13152.0000 (29a)
Stud / Timber Walls	93.0600	6.0000	87.0600	0.1700	14.8002	9.0000	783.5400 (29a)
Slope Roof	46.0600	0.4800	45.5800	0.1400	6.3812	9.0000	410.2200 (30)
Flat Ceilings	35.0000		35.0000	0.1400	4.9000	9.0000	315.0000 (30)
Between 1st & 2nd Floors	94.4000		94.4000	0.1400	13.2160	9.0000	849.6000 (30)
Dormer Roofs	7.8000		7.8000	0.1400	1.0920	9.0000	70.2000 (30)
Total net area of external elements Aum(A, m ²)			678.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	155.8639		(33)
Main dwelling							
Internal Walls			421.4400			9.0000	3792.9600 (32c)
First Floor			122.2800			18.0000	2201.0400 (32d)
Second Floor			47.8800			18.0000	861.8400 (32d)
Ground Floor Ceiling			122.2800			9.0000	1100.5200 (32e)
First Floor Ceiling			47.8800			9.0000	430.9200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	37874.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							121.2202 (35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	34.9000	0.0380	1.3262
E4 Jamb	65.6000	0.0160	1.0496
E16 Corner (normal)	84.5000	0.0390	3.2955
E10 Eaves (insulation at ceiling level)	70.2000	0.0610	4.2822
E11 Eaves (insulation at rafter level)	36.7000	0.0100	0.3670
E17 Corner (inverted - internal area greater than external area)	50.7000	-0.0910	-4.6137
E14 Flat roof	19.0000	0.1600	3.0400
E3 Sill	33.0000	0.0210	0.6930
R1 Head of roof window	0.6000	0.2400	0.1440
R2 Sill of roof window	0.6000	0.2400	0.1440
R3 Jamb of roof window	1.6000	0.2400	0.3840
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.1118 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	165.9757 (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	156.3029	154.5065	155.0901	152.8464	153.3846	151.3229	151.8156	150.8453	150.8453	152.3234	151.8156	153.9380 (38)
Average = Sum(39)m / 12 =	322.2786	320.4821	321.0658	318.8221	319.3603	317.2985	317.7912	316.8210	316.8210	318.2991	317.7912	319.9136 (39)
												318.8954
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0315	1.0257	1.0276	1.0204	1.0221	1.0156	1.0171	1.0140	1.0140	1.0188	1.0171	1.0239 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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Assumed occupancy												3.1481 (42)
Hot water usage for mixer showers	105.8794	104.2883	101.9696	97.5333	94.2595	90.6085	88.5333	90.8344	93.3568	97.2768	101.8084	105.4738 (42a)
Hot water usage for baths	33.2371	32.7435	32.0484	30.7667	29.8070	28.7429	28.1681	28.8583	29.6099	30.7486	32.0566	33.1248 (42b)
Hot water usage for other uses	46.8697	45.1654	43.4610	41.7567	40.0523	38.3479	38.3479	40.0523	41.7567	43.4610	45.1654	46.8697 (42c)
Average daily hot water use (litres/day)												171.0422 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	185.9863	182.1971	177.4790	170.0567	164.1188	157.6993	155.0493	159.7450	164.7233	171.4864	179.0304	185.4682 (44)
Energy content (annual)	294.5568	259.4463	272.7787	232.7991	220.9354	193.9097	187.5187	197.7976	203.1203	232.7054	255.0616	290.3984 (45)
Distribution loss (46)m = 0.15 x (45)m	44.1835	38.9169	40.9168	34.9199	33.1403	29.0865	28.1278	29.6696	30.4680	34.9058	38.2592	43.5598 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1232 (55)
Total storage loss	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (56)
If cylinder contains dedicated solar storage	34.8192	31.4496	34.8192	33.6960	34.8192	33.6960	34.8192	34.8192	33.6960	34.8192	33.6960	34.8192 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	352.6384	311.9071	329.4645	282.2535	266.2227	237.5110	232.5733	243.7828	253.9254	289.3913	311.2696	348.4800 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												735.9262 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												735.9262
Solar input	-0.0000	-20.1037	-64.3575	-90.9394	-116.5156	-114.4003	-113.7418	-102.2199	-70.6476	-38.6519	-4.3485	-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	352.6384	291.8034	265.1070	191.3141	149.7071	123.1106	118.8315	141.5629	183.2778	250.7394	306.9211	348.4800 (64)
	Total per year (kWh/year) = Sum(64)m =											2723.4935 (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	144.4054	128.2345	136.0476	116.9692	109.6909	99.3560	98.3937	102.5558	108.1816	122.7232	129.7744	143.0228 (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	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861	188.8861 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.6908	66.3397	53.9511	40.8444	30.5317	25.7761	27.8520	36.2031	48.5917	61.6984	72.0111	76.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	698.8981	706.1505	687.8747	648.9678	599.8548	553.6955	522.8583	515.6059	533.8817	572.7886	621.9016	668.0609 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367	57.0367 (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)	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241	-125.9241 (71)
Water heating gains (Table 5)	194.0933	190.8252	182.8597	162.4573	147.4340	137.9944	132.2496	137.8439	150.2522	164.9506	180.2422	192.2349 (72)
Total internal gains	1087.6809	1083.3141	1044.6842	972.2683	897.8192	837.4649	802.9586	809.6517	852.7244	919.4363	994.1536	1057.0612 (73)

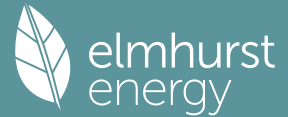
6. Solar gains

[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				12.5400	12.7500		0.7600		0.7000		0.7700		58.9457 (74)
Northeast				0.7800	13.7758		0.7600		0.7000		0.7700		3.9615 (75)
South				24.7200	54.0600		0.7600		0.7000		0.7700		492.6851 (78)
West				1.3200	23.7835		0.7600		0.7000		0.7700		11.5743 (80)
Northwest				0.7800	13.7758		0.7600		0.7000		0.7700		3.9615 (81)
East				0.4800	31.5802		0.7600		0.7000		1.0000		7.2579 (82)
Solar gains	578.3859	863.7207	1136.5791	1424.3347	1564.3640	1643.7046	1580.1545	1475.2023	1307.6612	1000.8226	679.6298		499.9294 (83)
Total gains	1666.0668	1947.0348	2181.2633	2396.6030	2462.1832	2481.1694	2383.1131	2284.8540	2160.3856	1920.2589	1673.7835		1556.9906 (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	32.6443	32.8273	32.7676	32.9982	32.9426	33.1567	33.1053	33.2067	33.2067	33.0525	33.1053	32.8856
alpha	3.1763	3.1885	3.1845	3.1999	3.1962	3.2104	3.2070	3.2138	3.2138	3.2035	3.2070	3.1924

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util living area	0.9818	0.9697	0.9459	0.8952	0.8015	0.6392	0.4768	0.5141	0.7501	0.9087	0.9696	0.9851 (86)
Living	19.2881	19.4848	19.8066	20.2019	20.5545	20.7890	20.8718	20.8624	20.6912	20.2679	19.6970	19.2415
Non living	18.0330	18.2858	18.6912	19.1866	19.6064	19.8617	19.9308	19.9274	19.7688	19.2760	18.5628	17.9782
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	8	0	0	0	0	0	0	0	0	0	0	0
16 / 9	23	22	0	0	0	0	0	0	0	0	0	31
MIT	20.2806	20.0011	19.8066	20.2019	20.5545	20.7890	20.8718	20.8624	20.6912	20.2679	19.6970	20.0040 (87)
Th 2	20.0572	20.0619	20.0604	20.0663	20.0649	20.0704	20.0691	20.0717	20.0717	20.0677	20.0691	20.0634 (88)
util rest of house												
MIT	0.9785	0.9644	0.9360	0.8748	0.7595	0.5634	0.3716	0.4097	0.6884	0.8867	0.9634	0.9824 (89)
MIT 2	19.3943	19.0654	18.6912	19.1866	19.6064	19.8617	19.9308	19.9274	19.7688	19.2760	18.5628	19.1430 (90)
Living area fraction									fLA = Living area / (4) =			0.0745 (91)
MIT	19.4603	19.1351	18.7743	19.2622	19.6770	19.9308	20.0009	19.9971	19.8375	19.3499	18.6473	19.2072 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4603	19.1351	18.7743	19.2622	19.6770	19.9308	20.0009	19.9971	19.8375	19.3499	18.6473	19.2072 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9761	0.9580	0.9184	0.8534	0.7392	0.5509	0.3634	0.4008	0.6705	0.8652	0.9502	0.9795	(94)
Useful gains	1626.1993	1865.2472	2003.2926	2045.2595	1820.1566	1366.7776	866.0193	915.6805	1448.4740	1661.4858	1590.4867	1524.9992	(95)
Ext temp.	4.8000	5.3000	7.0000	9.4000	12.4000	15.2000	17.2000	17.0000	14.4000	11.1000	7.5000	4.7000	(96)
Heat loss rate W	4724.7127	4433.9079	3780.3167	3144.2922	2323.9948	1501.0867	890.0986	949.5285	1722.7230	2625.9484	3542.5162	4641.0499	(97)
Space heating kWh	2305.2939	1726.1400	1322.1060	791.3036	374.8556	0.0000	0.0000	0.0000	0.0000	717.5602	1405.4613	2318.3417	(98a)
Space heating requirement - total per year (kWh/year)												10961.0622	
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	2305.2939	1726.1400	1322.1060	791.3036	374.8556	0.0000	0.0000	0.0000	0.0000	717.5602	1405.4613	2318.3417	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10961.0622	
Space heating per m2										(98c) / (4) =		35.0821	(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 %)													293.1275 (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	2305.2939	1726.1400	1322.1060	791.3036	374.8556	0.0000	0.0000	0.0000	0.0000	717.5602	1405.4613	2318.3417	(98)
Space heating efficiency (main heating system 1)	293.1275	293.1275	293.1275	293.1275	293.1275	0.0000	0.0000	0.0000	0.0000	293.1275	293.1275	293.1275	(210)
Space heating fuel (main heating system)	786.4476	588.8701	451.0345	269.9520	127.8814	0.0000	0.0000	0.0000	0.0000	244.7946	479.4710	790.8989	(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	352.6384	291.8034	265.1070	191.3141	149.7071	123.1106	118.8315	141.5629	183.2778	250.7394	306.9211	348.4800	(64)
Efficiency of water heater (217)m	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	160.8910	(216)
Fuel for water heating, kWh/month	219.1785	181.3671	164.7743	118.9092	93.0488	76.5180	73.8584	87.9868	113.9143	155.8443	190.7634	216.5939	(219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	65.3764	52.4474	47.2230	34.5976	26.7242	21.8339	24.3787	31.6884	41.1601	54.0042	60.9976	67.1934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-49.3599	-68.4762	-103.8036	-125.2789	-134.5050	-123.8619	-121.9921	-114.7714	-98.7138	-83.0720	-54.9181	-42.1598	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3739.3502	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												160.8910	
Water heating fuel used												1692.7569	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												527.6249	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1120.9127	(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													

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Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4918.8194	(238)

10a. Fuel costs - using BEDF prices (587)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3739.3502	28.4300	1063.0972 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1692.7569	28.4300	481.2508 (247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	28.4300	22.7440 (249)
Energy for lighting	527.6249	28.4300	150.0038 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1120.9127	28.4300	-318.6755
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-318.6755 (252)
Total energy cost			1398.4203 (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	3739.3502	0.1555	581.5106 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1692.7569	0.1451	245.6792 (264)
Space and water heating			827.1898 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	527.6249	0.1443	76.1526 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1120.9127	0.1341	-150.3178
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-150.3178 (269)
Total CO2, kg/year			764.1215 (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	3739.3502	1.5757	5892.1562 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1692.7569	1.5368	2601.5082 (278)
Space and water heating			8493.6644 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	527.6249	1.5338	809.2887 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1120.9127	1.4956	-1676.4359
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1676.4359 (283)
Total Primary energy kWh/year			7747.5412 (286)