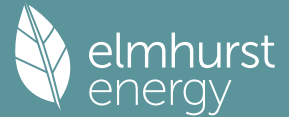


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Plot Reference	73a Keith Road				Issued on Date	02/07/2026	
Assessment Reference	Be Green			Plot Type Ref			
Plot Address	73a, Keith Road, Hayes, UB3 4HP				SAP Version	10.2	
SAP Rating	96 A	DER	-0.27	TER	11.90		
Environmental	100 A	% DER < TER			102.27		
CO ₂ Emissions (t/year)	-0.07	DFEE	36.58	TFEE	39.80		
Compliance Check	See BREL	% DFEE < TFEE			8.11		
% DPER < TPER	80.89	DPER	11.90	TPER	62.24		
Assessor Details	Mr. Benjamin Leech				Assessor ID	AW86-0001	
Client	Faluck Patel, Faluck Patel						

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	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.6974 (5)

2. Ventilation rate

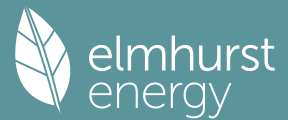
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1651 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4151 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3840 (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	0.4896	0.4800	0.4704	0.4224	0.4128	0.3648	0.3648	0.3552	0.3840	0.4128	0.4320	0.4512 (22b)
Effective ac	0.6198	0.6152	0.6106	0.5892	0.5852	0.5665	0.5665	0.5631	0.5737	0.5852	0.5933	0.6018 (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							
Solid Door			1.7900	1.0000	1.7900		(26)
Window			11.1900	1.1450	12.8130		(27)
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000 (28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400 (29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160 (30)
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720 (31)
Total net area of external elements Aum(A, m ²)			160.7800				(32)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358		(33)
Main dwelling							
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850 (32)
Internal Walls			94.1700			8.8000	828.6960 (32c)
Internal Floor			35.8200			17.6000	630.4320 (32d)
Internal Ceiling			35.8200			8.8000	315.2160 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14000.4570 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.5771 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.9500	0.2140	1.7013	

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E3 Sill	4.2000	0.0200	0.0840
E4 Jamb	15.7200	0.0150	0.2358
E5 Ground floor (normal)	17.5500	0.0510	0.8951
P1 Party wall - Ground floor	10.3500	0.0360	0.3726
E6 Intermediate floor within a dwelling	13.5500	0.0010	0.0136
E24 Eaves (insulation at ceiling level - inverted)	3.6000	0.1500	0.5400
P2 Party wall - Intermediate floor within a dwelling	9.9500	0.0000	0.0000
E14 Flat roof	4.4000	0.1600	0.7040
E10 Eaves (insulation at ceiling level)	17.1500	0.0560	0.9604
P4 Party wall - Roof (insulation at ceiling level)	9.9500	0.0330	0.3283
E16 Corner (normal)	9.9400	0.0380	0.3777
E18 Party wall between dwellings	9.9400	0.0400	0.3976
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6104 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	43.3461 (37)

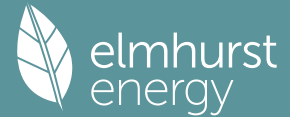
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.1657	36.8866	36.6131	35.3285	35.0882	33.9693	33.9693	33.7621	34.4003	35.0882	35.5744	36.0827 (38)
Average = Sum(39)m / 12 =	80.5118	80.2328	79.9593	78.6747	78.4343	77.3154	77.3154	77.1083	77.7464	78.4343	78.9205	79.4289 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1017	1.0979	1.0941	1.0766	1.0733	1.0580	1.0580	1.0551	1.0639	1.0733	1.0799	1.0869 (40)
HLP (average)												1.0765
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3185 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740 (42c)
Average daily hot water use (litres/day)												34.8854 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740 (44)
Energy content (annual)	60.7750	52.6569	54.6899	46.8013	44.1447	38.6061	37.9718	40.6037	42.1569	48.2860	52.6827	60.0843 (45)
Distribution loss (46)m = 0.15 x (45)m	9.1162	7.8985	8.2035	7.0202	6.6217	5.7909	5.6958	6.0906	6.3235	7.2429	7.9024	9.0127 (46)
Water storage loss (or HIU loss):												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6534 (55)
Total storage loss	20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554 (56)
If cylinder contains dedicated solar storage	20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554 (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	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1091.8463 (64)
Electric shower(s)	64.8922	57.8195	63.1367	60.2505	61.3811	58.5516	60.5034	61.3811	60.2505	63.1367	61.9495	64.8922 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											738.1451 (64a)
Heat gains from water heating, kWh/month	71.2450	63.4084	68.7828	64.3153	64.8376	61.1656	62.5657	63.6603	62.7710	66.6535	66.6956	71.0153 (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
115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
108.5047	120.1302	108.5047	112.1215	108.5047	112.1215	108.5047	112.1215	108.5047	112.1215	108.5047	112.1215	108.5047 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
204.3762	206.4970	201.1527	189.7753	175.4134	161.9152	152.8976	150.7768	156.1211	167.4985	181.8604	195.3586	195.3586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926 (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)												
-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408 (71)
Water heating gains (Table 5)												
95.7594	94.3578	92.4500	89.3267	87.1474	84.9523	84.0937	85.5649	87.1819	89.5880	92.6327	95.4507	95.4507 (72)
Total internal gains	466.4181	478.7628	459.8852	449.0013	428.8432	416.7668	403.2737	402.6241	413.2023	423.3690	444.3924	457.0918 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
North	7.8600	10.6334	0.4500	0.0000	0.7700	28.9599 (74)						
South	3.3300	46.7521	0.4500	0.0000	0.7700	53.9446 (78)						

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Solar gains	82.9046	143.6913	206.5818	278.2504	336.0309	345.3944	328.0099	282.3889	230.6302	161.1707	99.6686	70.7556 (83)
Total gains	549.3226	622.4541	666.4670	727.2517	764.8741	762.1612	731.2837	685.0130	643.8325	584.5397	544.0610	527.8474 (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	48.3037	48.4717	48.6375	49.4316	49.5831	50.3006	50.3006	50.4358	50.0218	49.5831	49.2776	48.9623
alpha	4.2202	4.2314	4.2425	4.2954	4.3055	4.3534	4.3534	4.3624	4.3348	4.3055	4.2852	4.2642
util living area	0.9863	0.9759	0.9571	0.9023	0.7918	0.6107	0.4562	0.5032	0.7319	0.9186	0.9744	0.9883 (86)
Living	19.5399	19.7543	20.0497	20.4589	20.7733	20.9460	20.9879	20.9817	20.8804	20.4897	19.9639	19.5168
Non living	18.3096	18.5825	18.9554	19.4649	19.8230	20.0006	20.0304	20.0296	19.9433	19.5128	18.8604	18.2887
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.2531	19.7543	20.0497	20.4589	20.7733	20.9460	20.9879	20.9817	20.8804	20.4897	19.9639	19.7243 (87)
Th 2	19.9995	20.0026	20.0056	20.0200	20.0227	20.0353	20.0353	20.0377	20.0305	20.0227	20.0173	20.0116 (88)
util rest of house												
	0.9830	0.9701	0.9463	0.8778	0.7423	0.5320	0.3604	0.4045	0.6586	0.8930	0.9672	0.9855 (89)
MIT 2	19.3258	18.5825	18.9554	19.4649	19.8230	20.0006	20.0304	20.0296	19.9433	19.5128	18.8604	18.5991 (90)
Living area fraction									FLA = Living area / (4) =			0.4298 (91)
MIT	19.7243	19.0861	19.4257	19.8921	20.2314	20.4069	20.4419	20.4388	20.3461	19.9327	19.3347	19.0827 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7243	19.0861	19.4257	19.8921	20.2314	20.4069	20.4419	20.4388	20.3461	19.9327	19.3347	19.0827 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9819	0.9632	0.9386	0.8741	0.7537	0.5634	0.4014	0.4466	0.6841	0.8903	0.9607	0.9820 (94)
Useful gains	539.3821	599.5400	625.5706	635.7084	576.4608	429.3889	293.5208	305.8928	440.4329	520.3898	522.7036	518.3243 (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	1241.8417	1138.1933	1033.5330	864.8019	669.1568	448.9669	297.0415	311.4263	485.6098	732.0045	965.5668	1182.1175 (97)
Space heating kWh	522.6299	361.9750	303.5240	164.9474	68.9658	0.0000	0.0000	0.0000	0.0000	157.4413	318.8615	493.8622 (98a)
Space heating requirement - total per year (kWh/year)												2392.2072
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	522.6299	361.9750	303.5240	164.9474	68.9658	0.0000	0.0000	0.0000	0.0000	157.4413	318.8615	493.8622 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2392.2072
Space heating per m2										(98c) / (4) =		32.7341 (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 %)												363.5816 (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	522.6299	361.9750	303.5240	164.9474	68.9658	0.0000	0.0000	0.0000	0.0000	157.4413	318.8615	493.8622 (98)
Space heating efficiency (main heating system 1)	363.5816	363.5816	363.5816	363.5816	363.5816	0.0000	0.0000	0.0000	0.0000	363.5816	363.5816	363.5816 (210)
Space heating fuel (main heating system)	143.7449	99.5581	83.4817	45.3674	18.9685	0.0000	0.0000	0.0000	0.0000	43.3029	87.7001	135.8326 (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	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (64)
Efficiency of water heater (217)m	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487 (216)
Fuel for water heating, kWh/month	33.3471	29.4049	31.4015	28.4303	28.0297	25.8099	26.0559	26.8975	26.9452	29.3538	30.3108	33.1263 (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	20.9784	16.8296	15.1532	11.1019	8.5754	7.0062	7.8228	10.1684	13.2077	17.3292	19.5733	21.5614 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.9546	-59.8448	-93.9513	-110.7579	-120.1808	-110.3717	-109.2433	-101.4209	-86.4543	-69.8075	-43.8109	-32.7712 (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	-15.0737	-37.0410	-87.4449	-153.6896	-223.2622	-233.7105	-227.6097	-182.0631	-120.3446	-58.6459	-21.6373	-11.5022 (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												657.9561 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												312.7487

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Water heating fuel used	349.1130 (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)	169.3075 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2349.5940 (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	-435.0724 (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	657.9561	0.1556	102.3964 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	349.1130	0.1403	48.9681 (264)
Energy for instantaneous electric shower(s)	738.1451	0.1391	102.6923 (264a)
Space and water heating			151.3645 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	169.3075	0.1443	24.4363 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-977.5693	0.1337	-130.7297
PV Unit electricity exported	-1372.0247	0.1221	-167.5094
Total			-298.2391 (269)
Total CO2, kg/year			-19.7460 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.2700 (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	657.9561	1.5761	1037.0326 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	349.1130	1.5186	530.1678 (278)
Energy for instantaneous electric shower(s)	738.1451	1.5143	1117.7983 (278a)
Space and water heating			1567.2004 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	169.3075	1.5338	259.6895 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-977.5693	1.4942	-1460.6938
PV Unit electricity exported	-1372.0247	0.4480	-614.6199
Total			-2075.3137 (283)
Total Primary energy kWh/year			869.3745 (286)
Dwelling Primary energy Rate (DPER)			11.9000 (287)

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

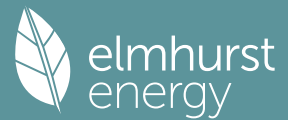
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.6974 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1651 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4151 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)

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Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3840 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Effective ac	0.4896	0.4800	0.4704	0.4224	0.4128	0.3648	0.3648	0.3552	0.3840	0.4128	0.4320	0.4512	(22b)
	0.6198	0.6152	0.6106	0.5892	0.5852	0.5665	0.5665	0.5631	0.5737	0.5852	0.5933	0.6018	(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			1.7900	1.0000	1.7900			(26)
TER Opening Type			11.1900	1.1450	12.8130			(27)
Ground Floor			37.2600	0.1300	4.8438			(28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904			(29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402			(30)
Flat Roof	1.4400		1.4400	0.1100	0.1584			(30)
Total net area of external elements Aum(A, m2)			160.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358			(33)
Main dwelling								
Party Wall			50.4700	0.0000	0.0000			(32)

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

191.5771 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	7.9500	0.0500	0.3975	
E2 Other lintels (including other steel lintels)	4.2000	0.0500	0.2100	
E3 Sill	15.7200	0.0500	0.7860	
E4 Jamb	17.5500	0.1600	2.8080	
E5 Ground floor (normal)	10.3500	0.0800	0.8280	
E6 Intermediate floor within a dwelling	13.5500	0.0000	0.0000	
E24 Eaves (insulation at ceiling level - inverted)	3.6000	0.2400	0.8640	
P2 Party wall - Intermediate floor within a dwelling	9.9500	0.0000	0.0000	
E14 Flat roof	4.4000	0.0800	0.3520	
E10 Eaves (insulation at ceiling level)	17.1500	0.0600	1.0290	
P4 Party wall - Roof (insulation at ceiling level)	9.9500	0.1200	1.1940	
E16 Corner (normal)	9.9400	0.0900	0.8946	
E18 Party wall between dwellings	9.9400	0.0600	0.5964	

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

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 46.6953 (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	37.1657	36.8866	36.6131	35.3285	35.0882	33.9693	33.9693	33.7621	34.4003	35.0882	35.5744	36.0827	(38)
Average = Sum(39)m / 12 =	83.8609	83.5819	83.3084	82.0238	81.7834	80.6646	80.6646	80.4574	81.0955	81.7834	82.2697	82.7780	(39)
												82.0226	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1475	1.1437	1.1400	1.1224	1.1191	1.1038	1.1038	1.1009	1.1097	1.1191	1.1257	1.1327	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

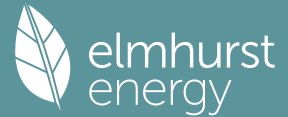
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3185 (42)
Hot water usage for mixer showers	81.0309	79.8131	78.0386	74.6435	72.1380	69.3438	67.7556	69.5167	71.4471	74.4472	77.9152	80.7204	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740	(42c)
Average daily hot water use (litres/day)													109.5931 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	119.4048	116.7917	113.6218	108.8312	104.9302	100.7407	99.1525	102.3089	105.6348	110.0303	114.8938	119.0943	(44)
Energy content (annual)	189.1080	166.3098	174.6324	148.9845	141.2563	123.8724	119.9163	126.6798	130.2583	149.3101	163.6872	186.4730	(45)
Distribution loss (46)m = 0.15 x (45)m	28.3662	24.9465	26.1949	22.3477	21.1884	18.5809	17.9874	19.0020	19.5387	22.3965	24.5531	27.9709	(46)
Water storage loss (or HIU loss):													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	238.3507	210.7870	223.8751	196.6387	190.4989	171.5266	169.1590	175.9225	177.9125	198.5527	211.3414	235.7156	(62)
WWHRS	-37.0439	-32.7619	-34.3064	-28.4071	-26.4744	-22.6543	-21.2348	-22.5811	-23.4390	-27.6320	-31.3037	-36.3579	(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	201.3068	178.0251	189.5687	168.2316	164.0246	148.8723	147.9242	153.3414	154.4735	170.9207	180.0377	199.3577	(64)
Total per year (kWh/year)													2056.0842 (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	102.2726	90.8798	97.4594	87.6607	86.3618	79.3109	79.2663	81.5152	81.4342	89.0397	92.5494	101.3964	(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	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.5047	120.1302	108.5047	112.1215	108.5047	112.1215	108.5047	108.5047	112.1215	108.5047	112.1215	108.5047 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.3762	206.4970	201.1527	189.7753	175.4134	161.9152	152.8976	150.7768	156.1211	167.4985	181.8604	195.3586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926 (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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408 (71)
Water heating gains (Table 5)	137.4631	135.2378	130.9938	121.7510	116.0778	110.1541	106.5407	109.5634	113.1031	119.6771	128.5408	136.2855 (72)
Total internal gains	511.1218	522.6428	501.4290	484.4256	460.7736	441.9685	425.7208	426.6227	439.1235	456.4580	483.3005	500.9266 (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					7.8600	10.6334	0.6300	0.7000			0.7700			25.5427 (74)
South					3.3300	46.7521	0.6300	0.7000			0.7700			47.5792 (78)
Solar gains	73.1218	126.7358	182.2051	245.4168	296.3793	304.6379	289.3048	249.0670	203.4158	142.1525	87.9077			62.4064 (83)
Total gains	584.2437	649.3785	683.6341	729.8424	757.1529	746.6064	715.0255	675.6896	642.5393	598.6106	571.2082			563.3330 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	46.3746	46.5294	46.6822	47.4133	47.5526	48.2122	48.2122	48.3363	47.9560	47.5526	47.2716	46.9813
alpha	4.0916	4.1020	4.1121	4.1609	4.1702	4.2141	4.2141	4.2224	4.1971	4.1702	4.1514	4.1321
util living area	0.9835	0.9733	0.9558	0.9074	0.8084	0.6387	0.4830	0.5274	0.7481	0.9182	0.9711	0.9856 (86)
MIT	19.5132	19.7142	20.0000	20.4021	20.7310	20.9284	20.9826	20.9749	20.8567	20.4549	19.9348	19.4910 (87)
Th 2	19.9622	19.9653	19.9683	19.9826	19.9853	19.9977	19.9977	20.0001	19.9929	19.9853	19.9799	19.9742 (88)
util rest of house	0.9795	0.9669	0.9447	0.8834	0.7594	0.5565	0.3791	0.4217	0.6737	0.8921	0.9630	0.9821 (89)
MIT 2	18.2500	18.5056	18.8664	19.3686	19.7467	19.9513	19.9908	19.9891	19.8881	19.4423	18.7971	18.2302 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7930	19.0251	19.3536	19.8128	20.1697	20.3713	20.4170	20.4128	20.3044	19.8775	19.2861	18.7721 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7930	19.0251	19.3536	19.8128	20.1697	20.3713	20.4170	20.4128	20.3044	19.8775	19.2861	18.7721 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9734	0.9593	0.9365	0.8787	0.7691	0.5885	0.4235	0.4666	0.6985	0.8888	0.9559	0.9766 (94)
Useful gains	568.7228	622.9632	640.2057	641.3441	582.3362	439.3627	302.8045	315.2438	448.7862	532.0622	546.0369	550.1524 (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	1215.3939	1180.6018	1070.8148	895.1098	692.6842	465.5362	307.9003	322.8619	503.1498	758.7490	1002.5429	1206.2481 (97)
Space heating kWh	481.1233	374.7331	320.3732	182.7113	82.0989	0.0000	0.0000	0.0000	0.0000	168.6550	328.6843	488.1352 (98a)
Space heating requirement - total per year (kWh/year)												2426.5143
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	481.1233	374.7331	320.3732	182.7113	82.0989	0.0000	0.0000	0.0000	0.0000	168.6550	328.6843	488.1352 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2426.5143
Space heating per m ²												(98c) / (4) = 33.2035 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	481.1233	374.7331	320.3732	182.7113	82.0989	0.0000	0.0000	0.0000	0.0000	168.6550	328.6843	488.1352 (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)	521.2603	405.9947	347.0999	197.9537	88.9479	0.0000	0.0000	0.0000	0.0000	182.7248	356.1044	528.8572 (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	201.3068	178.0251	189.5687	168.2316	164.0246	148.8723	147.9242	153.3414	154.4735	170.9207	180.0377	199.3577 (64)
Efficiency of water heater												79.8000 (216)

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(217)m	85.9408	85.6875	85.2268	84.2453	82.5922	79.8000	79.8000	79.8000	79.8000	84.0299	85.3917	85.9878	(217)
Fuel for water heating, kWh/month	234.2388	207.7607	222.4285	199.6925	198.5956	186.5568	185.3687	192.1572	193.5758	203.4047	210.8375	231.8441	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	22.5451	18.0865	16.2849	11.9310	9.2159	7.5294	8.4070	10.9278	14.1941	18.6234	21.0351	23.1717	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.7776	-48.9838	-70.3476	-79.0311	-85.1752	-79.4967	-78.5260	-74.1632	-66.4418	-55.9954	-38.2226	-30.0737	(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	-19.7784	-41.5969	-82.6565	-124.1115	-164.0698	-164.8295	-162.8774	-137.9126	-101.1009	-59.4612	-26.3996	-15.6399	(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												2628.9429	(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												2466.4608	(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)												181.9521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1841.6689	(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												3521.6870	(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	2628.9429	0.2100	552.0780 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2466.4608	0.2100	517.9568 (264)
Space and water heating			1070.0348 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	181.9521	0.1443	26.2613 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-741.2347	0.1346	-99.7711
PV Unit electricity exported	-1100.4341	0.1259	-138.5508
Total			-238.3219 (269)
Total CO2, kg/year			869.9035 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9000 (273)

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

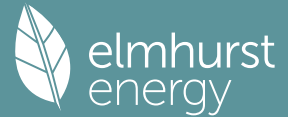
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2628.9429	1.1300	2970.7055 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2466.4608	1.1300	2787.1007 (278)
Space and water heating			5757.8062 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	181.9521	1.5338	279.0842 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-741.2347	1.4975	-1109.9723
PV Unit electricity exported	-1100.4341	0.4622	-508.5773
Total			-1618.5496 (283)
Total Primary energy kWh/year			4548.4416 (286)
Target Primary Energy Rate (TPER)			62.2400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.6974 (5)

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2. Ventilation rate

											m3 per hour				
Number of open chimneys	0 * 80 =											0.0000 (6a)			
Number of open flues	0 * 20 =											0.0000 (6b)			
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)			
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)			
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)			
Number of blocked chimneys	0 * 20 =											0.0000 (6f)			
Number of intermittent extract fans	3 * 10 =											30.0000 (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) =											30.0000 / (5) =		0.1651 (8)	
Pressure test												Yes			
Pressure Test Method												Blower Door			
Measured/design AP50												5.0000 (17)			
Infiltration rate												0.4151 (18)			
Number of sides sheltered												1 (19)			
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.9250 (20)			
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3840 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)		
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	0.4896	0.4800	0.4704	0.4224	0.4128	0.3648	0.3648	0.3552	0.3840	0.4128	0.4320	0.4512	(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	0.6198	0.6152	0.6106	0.5892	0.5852	0.5665	0.5665	0.5631	0.5737	0.5852	0.5933	0.6018	(25)		

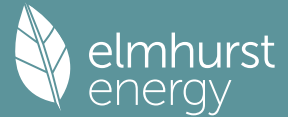
3. Heat losses and heat loss parameter

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												
Solid Door			1.7900	1.0000	1.7900			(26)				
Window			11.1900	1.1450	12.8130			(27)				
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000	(28a)				
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400	(29a)				
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160	(30)				
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720	(30)				
Total net area of external elements Aum(A, m2)			160.7800					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.7358			(33)				
Main dwelling												
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850	(32)				
Internal Walls			94.1700			8.8000	828.6960	(32c)				
Internal Floor			35.8200			17.6000	630.4320	(32d)				
Internal Ceiling			35.8200			8.8000	315.2160	(32e)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14000.4570	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.5771	(35)				
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E2 Other lintels (including other steel lintels)				7.9500	0.2140	1.7013						
E3 Sill				4.2000	0.0200	0.0840						
E4 Jamb				15.7200	0.0150	0.2358						
E5 Ground floor (normal)				17.5500	0.0510	0.8951						
P1 Party wall - Ground floor				10.3500	0.0360	0.3726						
E6 Intermediate floor within a dwelling				13.5500	0.0010	0.0136						
E24 Eaves (insulation at ceiling level - inverted)				3.6000	0.1500	0.5400						
P2 Party wall - Intermediate floor within a dwelling				9.9500	0.0000	0.0000						
E14 Flat roof				4.4000	0.1600	0.7040						
E10 Eaves (insulation at ceiling level)				17.1500	0.0560	0.9604						
P4 Party wall - Roof (insulation at ceiling level)				9.9500	0.0330	0.3283						
E16 Corner (normal)				9.9400	0.0380	0.3777						
E18 Party wall between dwellings				9.9400	0.0400	0.3976						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6104	(36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	43.3461 (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	37.1657	36.8866	36.6131	35.3285	35.0882	33.9693	33.9693	33.7621	34.4003	35.0882	35.5744	36.0827 (38)
Average = Sum(39)m / 12 =	80.5118	80.2328	79.9593	78.6747	78.4343	77.3154	77.3154	77.1083	77.7464	78.4343	78.9205	79.4289 (39)
												78.6735
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1017	1.0979	1.0941	1.0766	1.0733	1.0580	1.0580	1.0551	1.0639	1.0733	1.0799	1.0869 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3185 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	27.2555	26.8508	26.2807	25.2297	24.4427	23.5701	23.0987	23.6648	24.2811	25.2148	26.2875	27.1634 (42b)
Hot water usage for other uses	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740 (42c)
Average daily hot water use (litres/day)												60.1556 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	65.6295	63.8293	61.8639	59.4174	57.2350	54.9670	54.4956	56.4571	58.4688	60.7980	63.2660	65.5374 (44)
	103.9411	90.8921	95.0824	81.3395	77.0493	67.5883	65.9077	69.9056	72.0979	82.5022	90.1341	102.6157 (45)

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Energy content (annual)											Total = Sum(45)m =	999.0559
Distribution loss (46)m = 0.15 x (45)m												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (46)	
Water storage loss (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 0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (57)	
Primary loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (59)
Combi loss	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month												
88.3499 77.2583 80.8201 69.1386 65.4919 57.4501 56.0216 59.4198 61.2832 70.1269 76.6139											87.2233 (62)	
WWHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (63a)
PV diverter	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (63b)
Solar input	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (63c)
FGHRS	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000											0.0000 0.0000 0.0000 (63d)
Output from w/h	88.3499 77.2583 80.8201 69.1386 65.4919 57.4501 56.0216 59.4198 61.2832 70.1269 76.6139											87.2233 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =										849.1975 (64)	
Electric shower(s)	50.5275 45.0204 49.1605 46.9133 47.7936 45.5905 47.1101 47.7936 46.9133 49.1605 48.2361											50.5275 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										574.7470 (64a)	
Heat gains from water heating, kWh/month	34.7193 30.5697 32.4952 29.0130 28.3214 25.7601 25.7829 26.8033 27.0491 29.8219 31.2125											34.4377 (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	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.5047	120.1302	108.5047	112.1215	108.5047	112.1215	108.5047	108.5047	112.1215	108.5047	112.1215	108.5047 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.3762	206.4970	201.1527	189.7753	175.4134	161.9152	152.8976	150.7768	156.1211	167.4985	181.8604	195.3586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926 (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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408 (71)
Water heating gains (Table 5)	46.6658	45.4906	43.6763	40.2958	38.0664	35.7780	34.6545	36.0260	37.5682	40.0831	43.3507	46.2872 (72)
Total internal gains	417.3245	429.8956	411.1115	399.9704	379.7622	367.5924	353.8345	353.0853	363.5886	373.8641	395.1104	407.9283 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	7.8600	10.6334	0.4500	0.0000	0.7700	28.9599 (74)
South	3.3300	46.7521	0.4500	0.0000	0.7700	53.9446 (78)
Solar gains	82.9046	143.6913	206.5818	278.2504	336.0309	345.3944
Total gains	500.2291	573.5869	617.6932	678.2207	715.7932	712.9869
						681.8444
						635.4741
						230.6302
						161.1707
						99.6686
						70.7556 (83)
						478.6839 (84)

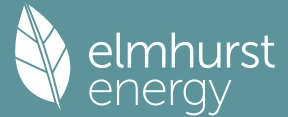
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48.3037 48.4717 48.6375 49.4316 49.5831 50.3006 50.3006 50.4358 50.0218 49.5831 49.2776 48.9623												48.9623
alpha	4.2202	4.2314	4.2425	4.2954	4.3055	4.3534	4.3534	4.3624	4.3348	4.3055	4.2852	4.2642
util living area	0.9903	0.9818	0.9665	0.9196	0.8191	0.6436	0.4865	0.5379	0.7688	0.9373	0.9816	0.9919 (86)
MIT	19.4554	19.6737	19.9752	20.3995	20.7380	20.9339	20.9844	20.9763	20.8540	20.4248	19.8826	19.4312 (87)
Th 2	19.9995	20.0026	20.0056	20.0200	20.0227	20.0353	20.0353	20.0377	20.0305	20.0227	20.0173	20.0116 (88)
util rest of house	0.9878	0.9773	0.9577	0.8983	0.7724	0.5637	0.3856	0.4343	0.6979	0.9162	0.9762	0.9898 (89)
MIT 2	18.5992	18.8172	19.1159	19.5341	19.8398	20.0016	20.0304	20.0294	19.9454	19.5672	19.0368	18.5843 (90)
Living area fraction	18.9672	19.1853	19.4853	19.9061	20.2258	20.4023	20.4404	20.4364	20.3359	19.9358	19.4003	0.4298 (91)
MIT	18.9672	19.1853	19.4853	19.9061	20.2258	20.4023	20.4404	20.4364	20.3359	19.9358	19.4003	18.9483 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9672	19.1853	19.4853	19.9061	20.2258	20.4023	20.4404	20.4364	20.3359	19.9358	19.4003	18.9483 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9845 0.9726 0.9521 0.8954 0.7829 0.5953 0.4288 0.4784 0.7220 0.9140 0.9719 0.9869 (94)												
Useful gains	492.4575	557.8542	588.1162	607.2940	560.4148	424.4529	292.3783	304.0280	429.0263	489.0066	480.8751	472.3963 (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	1180.8831	1146.1494	1038.2922	865.8999	668.7172	448.6088	296.9250	311.2400	484.8175	732.2445	970.7478	1171.4401 (97)
Space heating kWh	512.1886	395.3344	334.9309	186.1962	80.5770	0.0000	0.0000	0.0000	0.0000	180.9689	352.7084	520.0886 (98a)
Space heating requirement - total per year (kWh/year)												2562.9929
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	512.1886	395.3344	334.9309	186.1962	80.5770	0.0000	0.0000	0.0000	0.0000	180.9689	352.7084	520.0886 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2562.9929
Space heating per m2												(98c) / (4) = 35.0711 (99)

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8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	726.7652	572.1343	586.0227	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8446	0.9061	0.8789	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	613.8617	518.3896	515.0403	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	788.2439	754.1064	702.0650	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	125.5552	175.3732	139.1464	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.3888	43.8433	34.7866	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												110.0187 (107)
Energy for space heating												35.0711 (99)
Energy for space cooling												1.5055 (108)
Total												36.5765 (109)
Fabric Energy Efficiency (DFEE)												36.6 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.6974 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1651 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4151 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3840 (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	0.4896	0.4800	0.4704	0.4224	0.4128	0.3648	0.3648	0.3552	0.3840	0.4128	0.4320	0.4512 (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	0.6198	0.6152	0.6106	0.5892	0.5852	0.5665	0.5665	0.5631	0.5737	0.5852	0.5933	0.6018 (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			1.7900	1.0000	1.7900		(26)
TER Opening Type			11.1900	1.1450	12.8130		(27)
Ground Floor			37.2600	0.1300	4.8438		(28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904		(29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402		(30)
Flat Roof	1.4400		1.4400	0.1100	0.1584		(30)
Total net area of external elements Aum(A, m2)			160.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358		(33)
Main dwelling							
Party Wall			50.4700	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.5771 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				7.9500	0.0500		0.3975
E3 Sill				4.2000	0.0500		0.2100

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E4 Jamb	15.7200	0.0500	0.7860
E5 Ground floor (normal)	17.5500	0.1600	2.8080
P1 Party wall - Ground floor	10.3500	0.0800	0.8280
E6 Intermediate floor within a dwelling	13.5500	0.0000	0.0000
E24 Eaves (insulation at ceiling level - inverted)	3.6000	0.2400	0.8640
P2 Party wall - Intermediate floor within a dwelling	9.9500	0.0000	0.0000
E14 Flat roof	4.4000	0.0800	0.3520
E10 Eaves (insulation at ceiling level)	17.1500	0.0600	1.0290
P4 Party wall - Roof (insulation at ceiling level)	9.9500	0.1200	1.1940
E16 Corner (normal)	9.9400	0.0900	0.8946
E18 Party wall between dwellings	9.9400	0.0600	0.5964
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.9595 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	46.6953 (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	37.1657	36.8866	36.6131	35.3285	35.0882	33.9693	33.9693	33.7621	34.4003	35.0882	35.5744	36.0827	(38)
Heat transfer coeff	83.8609	83.5819	83.3084	82.0238	81.7834	80.6646	80.6646	80.4574	81.0955	81.7834	82.2697	82.7780	(39)
Average = Sum(39)m / 12 =												82.0226	
HLP	1.1475	1.1437	1.1400	1.1224	1.1191	1.1038	1.1038	1.1009	1.1097	1.1191	1.1257	1.1327	(40)
HLP (average)												1.1224	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.3185 (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	27.2555	26.8508	26.2807	25.2297	24.4427	23.5701	23.0987	23.6648	24.2811	25.2148	26.2875	27.1634 (42b)
Hot water usage for other uses	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740 (42c)
Average daily hot water use (litres/day)												60.1556 (43)
Daily hot water use	65.6295	63.8293	61.8639	59.4174	57.2350	54.9670	54.4956	56.4571	58.4688	60.7980	63.2660	65.5374 (44)
Energy content (annual)	103.9411	90.8921	95.0824	81.3395	77.0493	67.5883	65.9077	69.9056	72.0979	82.5022	90.1341	102.6157 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss (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 (56)
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 (57)
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 (59)
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 (61)
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 (62)
Total heat required for water heating calculated for each month	88.3499	77.2583	80.8201	69.1386	65.4919	57.4501	56.0216	59.4198	61.2832	70.1269	76.6139	87.2233 (63a)
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 (63b)
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 (63c)
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 (63d)
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 (64)
Output from w/h	88.3499	77.2583	80.8201	69.1386	65.4919	57.4501	56.0216	59.4198	61.2832	70.1269	76.6139	87.2233 (64)
12Total per year (kWh/year)												849.1975 (64a)
Electric shower(s)	50.5275	45.0204	49.1605	46.9133	47.7936	45.5905	47.1101	47.7936	46.9133	49.1605	48.2361	50.5275 (64a)
Heat gains from water heating, kWh/month	34.7193	30.5697	32.4952	29.0130	28.3214	25.7601	25.7829	26.8033	27.0491	29.8219	31.2125	34.4377 (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	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260	115.9260 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	108.5047	120.1302	108.5047	112.1215	108.5047	112.1215	108.5047	108.5047	112.1215	108.5047	112.1215	108.5047 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.3762	206.4970	201.1527	189.7753	175.4134	161.9152	152.8976	150.7768	156.1211	167.4985	181.8604	195.3586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926	34.5926 (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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408 (71)
Water heating gains (Table 5)	46.6658	45.4906	43.6763	40.2958	38.0664	35.7780	34.6545	36.0260	37.5682	40.0831	43.3507	46.2872 (72)
Total internal gains	417.3245	429.8956	411.1115	399.9704	379.7622	367.5924	353.8345	353.0853	363.5886	373.8641	395.1104	407.9283 (73)

6. Solar gains												
[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Access factor Table 6d	Gains W						
North	7.8600	10.6334	0.6300	0.7000	0.7700	25.5427 (74)						
South	3.3300	46.7521	0.6300	0.7000	0.7700	47.5792 (78)						
Solar gains	73.1218	126.7358	182.2051	245.4168	296.3793	304.6379	289.3048	249.0670	203.4158	142.1525	87.9077	62.4064 (83)
Total gains	490.4463	556.6313	593.3166	645.3872	676.1415	672.2303	643.1393	602.1522	567.0044	516.0167	483.0181	470.3347 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.3746	46.5294	46.6822	47.4133	47.5526	48.2122	48.2122	48.3363	47.9560	47.5526	47.2716	46.9813	
alpha	4.0916	4.1020	4.1121	4.1609	4.1702	4.2141	4.2141	4.2224	4.1971	4.1702	4.1514	4.1321	
util living area	0.9911	0.9841	0.9719	0.9345	0.8509	0.6896	0.5307	0.5817	0.8022	0.9471	0.9837	0.9925 (86)	
MIT	19.3539	19.5624	19.8616	20.2951	20.6644	20.9042	20.9753	20.9639	20.8099	20.3444	19.7908	19.3313 (87)	
Th 2	19.9622	19.9653	19.9683	19.9826	19.9853	19.9977	19.9977	20.0001	19.9929	19.9853	19.9799	19.9742 (88)	
util rest of house	0.9888	0.9801	0.9643	0.9159	0.8074	0.6069	0.4194	0.4694	0.7331	0.9282	0.9788	0.9905 (89)	
MIT 2	18.4707	18.6795	18.9767	19.4070	19.7468	19.9478	19.9898	19.9873	19.8799	19.4624	18.9182	18.4572 (90)	
Living area fraction									fLA = Living area / (4) =				0.4298 (91)
MIT	18.8503	19.0590	19.3570	19.7887	20.1411	20.3589	20.4134	20.4071	20.2796	19.8415	19.2933	18.8329 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8503	19.0590	19.3570	19.7887	20.1411	20.3589	20.4134	20.4071	20.2796	19.8415	19.2933	18.8329 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9855	0.9755	0.9587	0.9117	0.8149	0.6384	0.4669	0.5169	0.7547	0.9250	0.9745	0.9876 (94)
Useful gains	483.3356	542.9790	568.7990	588.4064	550.9701	429.1472	300.2752	311.2608	427.9405	477.2997	470.6804	464.5173 (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	1220.2012	1183.4339	1071.0995	893.1354	690.3457	464.5395	307.6027	322.3992	501.1409	755.8026	1003.1348	1211.2811 (97)
Space heating kWh	548.2280	430.3857	373.7116	219.4049	103.6954	0.0000	0.0000	0.0000	0.0000	207.2062	383.3672	555.5922 (98a)
Space heating requirement - total per year (kWh/year)												2821.5911
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	548.2280	430.3857	373.7116	219.4049	103.6954	0.0000	0.0000	0.0000	0.0000	207.2062	383.3672	555.5922 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2821.5911
Space heating per m2										(98c) / (4) =		38.6096 (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	758.2470	596.9179	611.4761	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7986	0.8707	0.8398	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	605.5234	519.7327	513.5160	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	740.6064	708.8665	663.1174	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.2597	140.7156	111.3034	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	24.3149	35.1789	27.8259	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												87.3197 (107)
Energy for space heating												38.6096 (99)
Energy for space cooling												1.1949 (108)
Total												39.8045 (109)
Fabric Energy Efficiency (TFEE)												39.8 (109)

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

CALCULATION OF ENERGY RATING

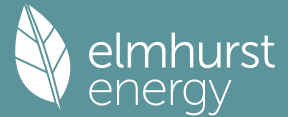
1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.6974 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

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Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1651 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.4151 (18)
 Number of sides sheltered 1 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3840 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4896	0.4800	0.4704	0.4224	0.4128	0.3648	0.3648	0.3552	0.3840	0.4128	0.4320	0.4512	(22b)
Effective ac	0.6198	0.6152	0.6106	0.5892	0.5852	0.5665	0.5665	0.5631	0.5737	0.5852	0.5933	0.6018	(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								
Solid Door			1.7900	1.0000	1.7900			(26)
Window			11.1900	1.1450	12.8130			(27)
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000	(28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400	(29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160	(30)
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720	(30)
Total net area of external elements Aum(A, m2)			160.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358			(33)
Main dwelling								
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850	(32)
Internal Walls			94.1700			8.8000	828.6960	(32c)
Internal Floor			35.8200			17.6000	630.4320	(32d)
Internal Ceiling			35.8200			8.8000	315.2160	(32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
 List of Thermal Bridges (28)...(30) + (32) + (32a)...(32e) = 14000.4570 (34)
 191.5771 (35)

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	7.9500	0.2140	1.7013	
E3 Sill	4.2000	0.0200	0.0840	
E4 Jamb	15.7200	0.0150	0.2358	
E5 Ground floor (normal)	17.5500	0.0510	0.8951	
P1 Party wall - Ground floor	10.3500	0.0360	0.3726	
E6 Intermediate floor within a dwelling	13.5500	0.0010	0.0136	
E24 Eaves (insulation at ceiling level - inverted)	3.6000	0.1500	0.5400	
P2 Party wall - Intermediate floor within a dwelling	9.9500	0.0000	0.0000	
E14 Flat roof	4.4000	0.1600	0.7040	
E10 Eaves (insulation at ceiling level)	17.1500	0.0560	0.9604	
P4 Party wall - Roof (insulation at ceiling level)	9.9500	0.0330	0.3283	
E16 Corner (normal)	9.9400	0.0380	0.3777	
E18 Party wall between dwellings	9.9400	0.0400	0.3976	

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 6.6104 (36)
 Total fabric heat loss (33) + (36) + (36a) = 43.3461 (37)

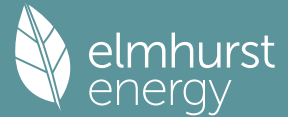
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
 (38)m Jan 37.1657 Feb 36.8866 Mar 36.6131 Apr 35.3285 May 35.0882 Jun 33.9693 Jul 33.9693 Aug 33.7621 Sep 34.4003 Oct 35.0882 Nov 35.5744 Dec 36.0827 (38)
 Heat transfer coeff 80.5118 80.2328 79.9593 78.6747 78.4343 77.3154 77.3154 77.1083 77.7464 78.4343 78.9205 79.4289 (39)
 Average = Sum(39)m / 12 = 78.6735

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1017	1.0979	1.0941	1.0766	1.0733	1.0580	1.0580	1.0551	1.0639	1.0733	1.0799	1.0869	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3185 (42)
Hot water usage for mixer showers													(42a)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													(42b)
Hot water usage for other uses													(42c)
38.3740 36.9785 35.5831 34.1877 32.7923 31.3969 31.3969 32.7923 34.1877 35.5831 36.9785 38.3740													(43)
Average daily hot water use (litres/day)													
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
38.3740 36.9785 35.5831 34.1877 32.7923 31.3969 31.3969 32.7923 34.1877 35.5831 36.9785 38.3740													(44)
Energy conte 60.7750 52.6569 54.6899 46.8013 44.1447 38.6061 37.9718 40.6037 42.1569 48.2860 52.6827 60.0843													(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													
9.1162 7.8985 8.2035 7.0202 6.6217 5.7909 5.6958 6.0906 6.3235 7.2429 7.9024 9.0127													(46)
Water storage loss (or HIU loss):													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6534 (55)
Total storage loss													
20.2554 18.2952 20.2554 19.6020 20.2554 19.6020 20.2554 20.2554 19.6020 20.2554 19.6020 20.2554													(56)
If cylinder contains dedicated solar storage													
20.2554 18.2952 20.2554 19.6020 20.2554 19.6020 20.2554 20.2554 19.6020 20.2554 19.6020 20.2554													(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													
104.2928 91.9633 98.2077 88.9153 87.6625 80.7201 81.4896 84.1215 84.2709 91.8038 94.7967 103.6021													(62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													(63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000													(63b)

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Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (64)
	Total per year (kWh/year) = Sum(64)m =										1091.8463	(64)
Electric shower(s)	64.8922	57.8195	63.1367	60.2505	61.3811	58.5516	60.5034	61.3811	60.2505	63.1367	61.9495	64.8922 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =										738.1451	(64a)
Heat gains from water heating, kWh/month	71.2450	63.4084	68.7828	64.3153	64.8376	61.1656	62.5657	63.6603	62.7710	66.6535	66.6956	71.0153 (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	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9672	21.2875	17.3121	13.1064	9.7972	8.2712	8.9373	11.6171	15.5924	19.7981	23.1074	24.6333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.0392	308.2045	300.2279	283.2467	261.8110	241.6645	228.2053	225.0400	233.0165	249.9978	271.4335	291.5800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	(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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	(71)
Water heating gains (Table 5)	95.7594	94.3578	92.4500	89.3267	87.1474	84.9523	84.0937	85.5649	87.1819	89.5880	92.6327	95.4507	(72)
Total internal gains	522.3658	521.4498	507.5901	483.2799	456.3556	432.4879	418.8363	419.8219	433.3909	456.9839	484.7736	509.2641	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.8600	10.6334	0.4500	0.0000	0.7700	28.9599 (74)
South	3.3300	46.7521	0.4500	0.0000	0.7700	53.9446 (78)

Solar gains	82.9046	143.6913	206.5818	278.2504	336.0309	345.3944	328.0099	282.3889	230.6302	161.1707	99.6686	70.7556 (83)
Total gains	605.2703	665.1411	714.1719	761.5302	792.3865	777.8824	746.8463	702.2108	664.0211	618.1546	584.4422	580.0197 (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	48.3037	48.4717	48.6375	49.4316	49.5831	50.3006	50.3006	50.4358	50.0218	49.5831	49.2776	48.9623
alpha	4.2202	4.2314	4.2425	4.2954	4.3055	4.3534	4.3534	4.3624	4.3348	4.3055	4.2852	4.2642
util living area	0.9808	0.9698	0.9466	0.8894	0.7765	0.6007	0.4473	0.4921	0.7173	0.9047	0.9674	0.9836 (86)
Living	19.6342	19.8228	20.1193	20.4976	20.7910	20.9493	20.9887	20.9832	20.8897	20.5305	20.0283	19.6059
Non living	18.4284	18.6679	19.0401	19.5088	19.8401	20.0029	20.0308	20.0303	19.9508	19.5590	18.9401	18.4012
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3013	19.8228	20.1193	20.4976	20.7910	20.9493	20.9887	20.9832	20.8897	20.5305	20.0283	19.8009 (87)
Th 2	19.9995	20.0026	20.0056	20.0200	20.0227	20.0353	20.0353	20.0377	20.0305	20.0227	20.0173	20.0116 (88)
util rest of house	0.9762	0.9627	0.9338	0.8628	0.7257	0.5226	0.3531	0.3950	0.6434	0.8762	0.9585	0.9797 (89)
MIT 2	19.3731	18.6679	19.0401	19.5088	19.8401	20.0029	20.0308	20.0303	19.9508	19.5590	18.9401	18.6914 (90)
Living area fraction	fLA = Living area / (4) =											0.4298 (91)
MIT	19.7721	19.1642	19.5040	19.9338	20.2488	20.4097	20.4425	20.4399	20.3543	19.9765	19.4078	19.1683 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7721	19.1642	19.5040	19.9338	20.2488	20.4097	20.4425	20.4399	20.3543	19.9765	19.4078	19.1683 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9552	0.9261	0.8602	0.7383	0.5538	0.3934	0.4364	0.6696	0.8747	0.9515	0.9754	(94)
Useful gains	590.1249	635.3688	661.3627	655.0460	585.0255	430.8285	293.8298	306.4431	444.6317	540.6699	556.1137	565.7731	(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	1245.6831	1144.4604	1039.7869	868.0769	670.5218	449.1789	297.0874	311.5074	486.2527	735.4429	971.3366	1188.9130	(97)
Space heating kWh	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98a)
Space heating requirement - total per year (kWh/year)												2235.8716	
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	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2235.8716	
Space heating per m2											(98c) / (4) =	30.5948	(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 %)	363.5816	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98)
Space heating efficiency (main heating system 1)	363.5816	363.5816	363.5816	363.5816	363.5816	0.0000	0.0000	0.0000	0.0000	363.5816	363.5816	363.5816	(210)
Space heating fuel (main heating system)	134.1474	94.0943	77.4373	42.1865	17.4952	0.0000	0.0000	0.0000	0.0000	39.8566	82.2265	127.5136	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(64)
Efficiency of water heater (217)m	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	(216)
Fuel for water heating, kWh/month	33.3471	29.4049	31.4015	28.4303	28.0297	25.8099	26.0559	26.8975	26.9452	29.3538	30.3108	33.1263	(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	20.9784	16.8296	15.1532	11.1019	8.5754	7.0062	7.8228	10.1684	13.2077	17.3292	19.5733	21.5614	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-38.8298	-59.6544	-93.5076	-110.3275	-119.8914	-110.3717	-109.2433	-101.4209	-86.4543	-69.5959	-43.6903	-32.6846	(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	-15.1985	-37.2314	-87.8886	-154.1200	-223.5516	-233.7105	-227.6097	-182.0631	-120.3446	-58.8576	-21.7578	-11.5888	(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												614.9573	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												312.7487	
Water heating fuel used												349.1130	(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)												169.3075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2349.5940	(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												-478.0712	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	614.9573	16.4900	101.4065	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	349.1130	16.4900	57.5687	(247)
Energy for instantaneous electric shower(s)	738.1451	16.4900	121.7201	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	169.3075	16.4900	27.9188	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.6718	16.4900	-160.8883	
PV Unit electricity exported	-1373.9222	5.5900	-76.8023	
Total			-237.6905	(252)
Total energy cost			70.9236	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.2162	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	96.4949	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	614.9573	0.1557	95.7325	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	349.1130	0.1403	48.9681	(264)
Energy for instantaneous electric shower(s)	738.1451	0.1391	102.6923	(264a)
Space and water heating			144.7006	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	169.3075	0.1443	24.4363	(268)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-975.6718	0.1337	-130.4502
PV Unit electricity exported	-1373.9222	0.1221	-167.8175
Total			-298.2677 (269)
Total CO2, kg/year			-26.4385 (272)
CO2 emissions per m2			-0.3600 (273)
EI value			100.3000
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 181.6974 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) =	0.1651 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4151	(18)
Number of sides sheltered		1	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3840	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.8000	3.5000	3.6000	3.4000	3.4000	3.7000	3.5000	4.0000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9500	0.8750	0.9000	0.8500	0.8500	0.9250	0.8750	1.0000 (22a)
Adj infilt rate	0.4032	0.3840	0.3840	0.3552	0.3648	0.3360	0.3456	0.3264	0.3264	0.3552	0.3360	0.3840 (22b)
Effective ac	0.5813	0.5737	0.5737	0.5631	0.5665	0.5564	0.5597	0.5533	0.5533	0.5631	0.5564	0.5737 (25)

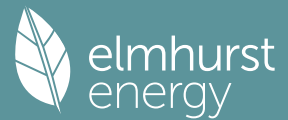
3. Heat losses and heat loss parameter

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							
Solid Door			1.7900	1.0000	1.7900		(26)
Window			11.1900	1.1450	12.8130		(27)
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000 (28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400 (29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160 (30)
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720 (30)
Total net area of external elements Aum(A, m2)			160.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358		(33)
Main dwelling							
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850 (32)
Internal Walls			94.1700			8.8000	828.6960 (32c)
Internal Floor			35.8200			17.6000	630.4320 (32d)
Internal Ceiling			35.8200			8.8000	315.2160 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14000.4570	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		191.5771	(35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	7.9500	0.2140	1.7013
E2 Other lintels (including other steel lintels)	4.2000	0.0200	0.0840
E3 Sill	15.7200	0.0150	0.2358
E4 Jamb	17.5500	0.0510	0.8951
E5 Ground floor (normal)	10.3500	0.0360	0.3726
P1 Party wall - Ground floor	13.5500	0.0010	0.0136
E6 Intermediate floor within a dwelling	3.6000	0.1500	0.5400
E24 Eaves (insulation at ceiling level - inverted)	9.9500	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	4.4000	0.1600	0.7040
E14 Flat roof	17.1500	0.0560	0.9604
E10 Eaves (insulation at ceiling level)	9.9500	0.0330	0.3283
P4 Party wall - Roof (insulation at ceiling level)	9.9400	0.0380	0.3777
E16 Corner (normal)	9.9400	0.0400	0.3976
E18 Party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6104 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) =		43.3461 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.8533	34.4003	34.4003	33.7621	33.9693	33.3643	33.5604	33.1737	33.1737	33.7621	33.3643	34.4003	(38)
Heat transfer coeff	78.1995	77.7464	77.7464	77.1083	77.3154	76.7104	76.9066	76.5198	76.5198	77.1083	76.7104	77.7464	(39)
Average = Sum(39)m / 12 =												77.1948	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0701	1.0639	1.0639	1.0551	1.0580	1.0497	1.0524	1.0471	1.0471	1.0551	1.0497	1.0639	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3185 (42)
Hot water usage for mixer showers													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
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	(42b)
Hot water usage for other uses													
38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740	34.8854	(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740	34.8854	(44)
Energy conte	60.7750	52.6569	54.6899	46.8013	44.1447	38.6061	37.9718	40.6037	42.1569	48.2860	52.6827	60.0843	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
9.1162	7.8985	8.2035	7.0202	6.6217	5.7909	5.6958	6.0906	6.3235	7.2429	7.9024	9.0127	9.0127	(46)
Water storage loss (or HIU loss):													
Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.6534 (55)
Total storage loss													
20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	(56)
If cylinder contains dedicated solar storage													
20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	(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													
104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	103.6021	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(64)
Total per year (kWh/year) = Sum(64)m =													1091.8463 (64)
Electric shower(s)													
64.8922	57.8195	63.1367	60.2505	61.3811	58.5516	60.5034	61.3811	60.2505	63.1367	61.9495	64.8922	64.8922	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													738.1451 (64a)
Heat gains from water heating, kWh/month													
71.2450	63.4084	68.7828	64.3153	64.8376	61.1656	62.5657	63.6603	62.7710	66.6535	66.6956	71.0153	71.0153	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
23.9672	21.2875	17.3121	13.1064	9.7972	8.2712	8.9373	11.6171	15.5924	19.7981	23.1074	24.6333	24.6333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
305.0392	308.2045	300.2279	283.2467	261.8110	241.6645	228.2053	225.0400	233.0165	249.9978	271.4335	291.5800	291.5800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	(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)													
-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	(71)
Water heating gains (Table 5)													
95.7594	94.3578	92.4500	89.3267	87.1474	84.9523	84.0937	85.5649	87.1819	89.5880	92.6327	95.4507	95.4507	(72)
Total internal gains	522.3658	521.4498	507.5901	483.2799	456.3556	432.4879	418.8363	419.8219	433.3909	456.9839	484.7736	509.2641	(73)

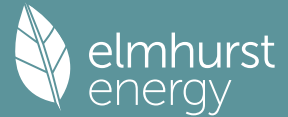
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.8600	12.3661		0.4500		0.0000		0.7700		33.6790 (74)
South				3.3300	52.5273		0.4500		0.0000		0.7700		60.6083 (78)
Solar gains	94.2874	142.7777	206.3998	288.1599	340.5754	375.0773	352.2246	307.3419	250.1734	173.7590	109.5831	77.0761	(83)
Total gains	616.6531	664.2275	713.9899	771.4398	796.9310	807.5652	771.0610	727.1638	683.5643	630.7430	594.3566	586.3402	(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		
49.7320	50.0218	50.0218	50.4358	50.3006	50.6974	50.5681	50.8236	50.8236	50.4358	50.6974	50.0218	50.0218	
alpha	4.3155	4.3348	4.3348	4.3624	4.3534	4.3712	4.3882	4.3882	4.3624	4.3798	4.3348	4.3348	
util living area													
0.9744	0.9622	0.9294	0.8432	0.6798	0.4303	0.2588	0.2937	0.5853	0.8541	0.9542	0.9784	0.9784	(86)

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Living	19.8373	20.0045	20.3062	20.6650	20.9016	20.9902	20.9993	20.9987	20.9617	20.7005	20.2226	19.7989
Non living	18.7035	18.9164	19.2887	19.7161	19.9610	20.0380	20.0398	20.0441	20.0229	19.7648	19.2002	18.6593
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4052	20.0045	20.3062	20.6650	20.9016	20.9902	20.9993	20.9987	20.9617	20.7005	20.2226	19.9669 (87)
Th 2	20.0254	20.0305	20.0305	20.0377	20.0353	20.0421	20.0399	20.0443	20.0443	20.0377	20.0421	20.0305 (88)
util rest of house	0.9682	0.9532	0.9122	0.8066	0.6139	0.3438	0.1635	0.1940	0.4955	0.8114	0.9415	0.9731 (89)
MIT 2	19.4984	18.9164	19.2887	19.7161	19.9610	20.0380	20.0398	20.0441	20.0229	19.7648	19.2002	18.9064 (90)
Living area fraction									FLA = Living area / (4) =			0.4298 (91)
MIT	19.8881	19.3841	19.7260	20.1239	20.3653	20.4472	20.4522	20.4544	20.4264	20.1669	19.6396	19.3622 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8881	19.3841	19.7260	20.1239	20.3653	20.4472	20.4522	20.4544	20.4264	20.1669	19.6396	19.3622 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9672	0.9457	0.9059	0.8102	0.6374	0.3808	0.2045	0.2369	0.5326	0.8178	0.9350	0.9685 (94)
Useful gains	596.4125	628.1701	646.8043	625.0257	507.9979	307.5446	157.7051	172.2664	364.0342	515.8162	555.7058	567.8486 (95)
Ext temp.	5.2000	5.8000	7.6000	10.2000	13.3000	16.4000	18.4000	18.2000	15.5000	11.9000	8.1000	5.2000 (96)
Heat loss rate W	1148.6054	1056.1132	942.7535	765.2171	546.2545	310.4652	157.8274	172.5049	376.9702	637.4480	885.2079	1101.0596 (97)
Space heating kWh	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98a)
Space heating requirement - total per year (kWh/year)												1772.4407
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	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1772.4407
Space heating per m2										(98c) / (4) =		24.2534 (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 %)												361.8965 (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	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98)
Space heating efficiency (main heating system 1)	361.8965	361.8965	361.8965	361.8965	361.8965	0.0000	0.0000	0.0000	0.0000	361.8965	361.8965	361.8965 (210)
Space heating fuel (main heating system)	113.5218	79.4641	60.8423	27.8914	7.8649	0.0000	0.0000	0.0000	0.0000	25.0055	65.5551	109.6195 (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	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (64)
Efficiency of water heater (217)m	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123 (216)
Fuel for water heating, kWh/month	33.3191	29.3801	31.3750	28.4063	28.0061	25.7882	26.0340	26.8748	26.9225	29.3291	30.2853	33.0984 (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	20.9784	16.8296	15.1532	11.1019	8.5754	7.0062	7.8228	10.1684	13.2077	17.3292	19.5733	21.5614 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.0920	-60.2925	-93.6625	-111.1284	-118.9022	-114.1889	-112.6194	-105.8734	-91.3113	-73.6762	-47.9242	-35.9515 (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	-19.5518	-39.1597	-92.0134	-166.1020	-230.6266	-259.9643	-249.9975	-205.2640	-137.4178	-69.0294	-26.5731	-14.0133 (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												489.7645 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												313.0123
Water heating fuel used												348.8189 (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)												169.3075 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2519.3354 (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												-773.2994 (238)

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10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	489.7645	27.6700	135.5178 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	348.8189	27.6700	96.5182 (247)
Energy for instantaneous electric shower(s)	738.1451	27.6700	204.2447 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	169.3075	27.6700	46.8474 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1009.6225	27.6700	-279.3626
PV Unit electricity exported	-1509.7129	5.8100	-87.7143
Total			-367.0769 (252)
Total energy cost			116.0513 (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	489.7645	0.1566	76.7214 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	348.8189	0.1403	48.9269 (264)
Energy for instantaneous electric shower(s)	738.1451	0.1391	102.6923 (264a)
Space and water heating			125.6482 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	169.3075	0.1443	24.4363 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1009.6225	0.1338	-135.0684
PV Unit electricity exported	-1509.7129	0.1219	-184.0783
Total			-319.1468 (269)
Total CO2, kg/year			-66.3699 (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	489.7645	1.5799	773.7906 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	348.8189	1.5186	529.7213 (278)
Energy for instantaneous electric shower(s)	738.1451	1.5143	1117.7983 (278a)
Space and water heating			1303.5119 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	169.3075	1.5338	259.6895 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1009.6225	1.4944	-1508.7681
PV Unit electricity exported	-1509.7129	0.4473	-675.3187
Total			-2184.0868 (283)
Total Primary energy kWh/year			496.9128 (286)

SAP 10 EPC IMPROVEMENTS

Be Green

Current energy efficiency rating: A 96
Current environmental impact rating: A 100

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

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

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.6 -£ 21 -11 kg (16.1%)

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

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£483	£483	£0
Space heating	£136	£136	£0
Water heating	£301	£301	£0
Lighting	£47	£47	£0
Generated (PV)	-£367	-£367	£0
Total cost of fuels	£116	£116	£0

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Total cost of uses	£117	£117	£0
Delivered energy	-11 kWh/m ²	-11 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-1 kg/m ²	0 kg/m ²
Primary energy	7 kWh/m ²	7 kWh/m ²	0 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.6974 (5)

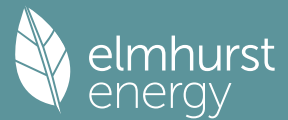
2. Ventilation rate

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	3 * 10 =	30.0000 (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) =	30.0000 / (5) =	0.1651 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4151	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3840 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000	(22)
Wind factor	1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750	(22a)
Adj infilt rate	0.4896 0.4800 0.4704 0.4224 0.4128 0.3648 0.3648 0.3552 0.3840 0.4128 0.4320 0.4512	(22b)
Effective ac	0.6198 0.6152 0.6106 0.5892 0.5852 0.5665 0.5665 0.5631 0.5737 0.5852 0.5933 0.6018	(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							
Solid Door			1.7900	1.0000	1.7900		(26)
Window			11.1900	1.1450	12.8130		(27)
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000 (28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400 (29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160 (30)
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720 (30)
Total net area of external elements Aum(A, m ²)			160.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358		(33)
Main dwelling							
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850 (32)
Internal Walls			94.1700			8.8000	828.6960 (32c)
Internal Floor			35.8200			17.6000	630.4320 (32d)
Internal Ceiling			35.8200			8.8000	315.2160 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14000.4570 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.5771 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.9500	0.2140	1.7013	
E3 Sill				4.2000	0.0200	0.0840	
E4 Jamb				15.7200	0.0150	0.2358	
E5 Ground floor (normal)				17.5500	0.0510	0.8951	
P1 Party wall - Ground floor				10.3500	0.0360	0.3726	
E6 Intermediate floor within a dwelling				13.5500	0.0010	0.0136	
E24 Eaves (insulation at ceiling level - inverted)				3.6000	0.1500	0.5400	
P2 Party wall - Intermediate floor within a dwelling				9.9500	0.0000	0.0000	
E14 Flat roof				4.4000	0.1600	0.7040	
E10 Eaves (insulation at ceiling level)				17.1500	0.0560	0.9604	
P4 Party wall - Roof (insulation at ceiling level)				9.9500	0.0330	0.3283	
E16 Corner (normal)				9.9400	0.0380	0.3777	
E18 Party wall between dwellings				9.9400	0.0400	0.3976	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6104 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	43.3461 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							

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(38)m	Jan 37.1657	Feb 36.8866	Mar 36.6131	Apr 35.3285	May 35.0882	Jun 33.9693	Jul 33.9693	Aug 33.7621	Sep 34.4003	Oct 35.0882	Nov 35.5744	Dec 36.0827	(38)
Heat transfer coeff	80.5118	80.2328	79.9593	78.6747	78.4343	77.3154	77.3154	77.1083	77.7464	78.4343	78.9205	79.4289	(39)
Average = Sum(39)m / 12 =												78.6735	
HLP	Jan 1.1017	Feb 1.0979	Mar 1.0941	Apr 1.0766	May 1.0733	Jun 1.0580	Jul 1.0580	Aug 1.0551	Sep 1.0639	Oct 1.0733	Nov 1.0799	Dec 1.0869	(40)
HLP (average)												1.0765	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3185	(42)
Hot water usage for mixer showers														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses														
38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740		(42c)	
Average daily hot water use (litres/day)													34.8854	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740		(44)	
Energy content (annual)	60.7750	52.6569	54.6899	46.8013	44.1447	38.6061	37.9718	40.6037	42.1569	48.2860	52.6827	60.0843	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =			579.4593	
9.1162	7.8985	8.2035	7.0202	6.6217	5.7909	5.6958	6.0906	6.3235	7.2429	7.9024	9.0127	(46)		
Water storage loss (or HIU loss):														
Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2100	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.6534	(55)
Total storage loss														
20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	(56)		
If cylinder contains dedicated solar storage														
20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	(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														
104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(62)		
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(64)	
								Total per year (kWh/year) = Sum(64)m =				1091.8463	(64)	
Electric shower(s)	64.8922	57.8195	63.1367	60.2505	61.3811	58.5516	60.5034	61.3811	60.2505	63.1367	61.9495	64.8922	(64a)	
												738.1451	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														
Heat gains from water heating, kWh/month														
71.2450	63.4084	68.7828	64.3153	64.8376	61.1656	62.5657	63.6603	62.7710	66.6535	66.6956	71.0153	(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	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9672	21.2875	17.3121	13.1064	9.7972	8.2712	8.9373	11.6171	15.5924	19.7981	23.1074	24.6333	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.0392	308.2045	300.2279	283.2467	261.8110	241.6645	228.2053	225.0400	233.0165	249.9978	271.4335	291.5800	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	(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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	(71)
Water heating gains (Table 5)	95.7594	94.3578	92.4500	89.3267	87.1474	84.9523	84.0937	85.5649	87.1819	89.5880	92.6327	95.4507	(72)
Total internal gains	522.3658	521.4498	507.5901	483.2799	456.3556	432.4879	418.8363	419.8219	433.3909	456.9839	484.7736	509.2641	(73)

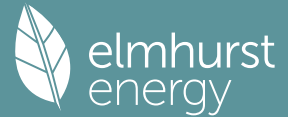
6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				7.8600	10.6334		0.4500	0.0000	0.7700		28.9599 (74)	
South				3.3300	46.7521		0.4500	0.0000	0.7700		53.9446 (78)	
Solar gains	82.9046	143.6913	206.5818	278.2504	336.0309	345.3944	328.0099	282.3889	230.6302	161.1707	99.6686	70.7556 (83)
Total gains	605.2703	665.1411	714.1719	761.5302	792.3865	777.8824	746.8463	702.2108	664.0211	618.1546	584.4422	580.0197 (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	48.3037	48.4717	48.6375	49.4316	49.5831	50.3006	50.3006	50.4358	50.0218	49.5831	49.2776	48.9623
alpha	4.2202	4.2314	4.2425	4.2954	4.3055	4.3534	4.3534	4.3624	4.3348	4.3055	4.2852	4.2642
util living area	0.9808	0.9698	0.9466	0.8894	0.7765	0.6007	0.4473	0.4921	0.7173	0.9047	0.9674	0.9836 (86)
Living	19.6342	19.8228	20.1193	20.4976	20.7910	20.9493	20.9887	20.9832	20.8897	20.5305	20.0283	19.6059

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Non living	18.4284	18.6679	19.0401	19.5088	19.8401	20.0029	20.0308	20.0303	19.9508	19.5590	18.9401	18.4012
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3013	19.8228	20.1193	20.4976	20.7910	20.9493	20.9887	20.9832	20.8897	20.5305	20.0283	19.8009 (87)
Th 2	19.9995	20.0026	20.0056	20.0200	20.0227	20.0353	20.0353	20.0377	20.0305	20.0227	20.0173	20.0116 (88)
util rest of house												
	0.9762	0.9627	0.9338	0.8628	0.7257	0.5226	0.3531	0.3950	0.6434	0.8762	0.9585	0.9797 (89)
MIT 2	19.3731	18.6679	19.0401	19.5088	19.8401	20.0029	20.0308	20.0303	19.9508	19.5590	18.9401	18.6914 (90)
Living area fraction									FLA = Living area / (4) =			0.4298 (91)
MIT	19.7721	19.1642	19.5040	19.9338	20.2488	20.4097	20.4425	20.4399	20.3543	19.9765	19.4078	19.1683 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7721	19.1642	19.5040	19.9338	20.2488	20.4097	20.4425	20.4399	20.3543	19.9765	19.4078	19.1683 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9552	0.9261	0.8602	0.7383	0.5538	0.3934	0.4364	0.6696	0.8747	0.9515	0.9754	(94)
Useful gains	590.1249	635.3688	661.3627	655.0460	585.0255	430.8285	293.8298	306.4431	444.6317	540.6699	556.1137	565.7731	(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	1245.6831	1144.4604	1039.7869	868.0769	670.5218	449.1789	297.0874	311.5074	486.2527	735.4429	971.3366	1188.9130	(97)
Space heating kWh	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98a)
Space heating requirement - total per year (kWh/year)												2235.8716	
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	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2235.8716	
Space heating per m2										(98c) / (4) =		30.5948	(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 %)													363.5816	(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	487.7353	342.1095	281.5476	153.3822	63.6092	0.0000	0.0000	0.0000	0.0000	144.9111	298.9605	463.6161	(98)	
Space heating efficiency (main heating system 1)	363.5816	363.5816	363.5816	363.5816	363.5816	0.0000	0.0000	0.0000	0.0000	363.5816	363.5816	363.5816	(210)	
Space heating fuel (main heating system)	134.1474	94.0943	77.4373	42.1865	17.4952	0.0000	0.0000	0.0000	0.0000	39.8566	82.2265	127.5136	(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	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(64)	
Efficiency of water heater (217)m	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	312.7487	(216)	
Fuel for water heating, kWh/month	33.3471	29.4049	31.4015	28.4303	28.0297	25.8099	26.0559	26.8975	26.9452	29.3538	30.3108	33.1263	(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	20.9784	16.8296	15.1532	11.1019	8.5754	7.0062	7.8228	10.1684	13.2077	17.3292	19.5733	21.5614	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-38.8298	-59.6544	-93.5076	-110.3275	-119.8914	-110.3717	-109.2433	-101.4209	-86.4543	-69.5959	-43.6903	-32.6846	(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)	-15.1985	-37.2314	-87.8886	-154.1200	-223.5516	-233.7105	-227.6097	-182.0631	-120.3446	-58.8576	-21.7578	-11.5888	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year														
Space heating fuel - main system 1													614.9573	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													312.7487	
Water heating fuel used													349.1130	(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)													169.3075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2349.5940	(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													-478.0712	(238)

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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	614.9573	16.4900	101.4065 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	349.1130	16.4900	57.5687 (247)
Energy for instantaneous electric shower(s)	738.1451	16.4900	121.7201 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	169.3075	16.4900	27.9188 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-975.6718	16.4900	-160.8883
PV Unit electricity exported	-1373.9222	5.5900	-76.8023
Total			-237.6905 (252)
Total energy cost			70.9236 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 0.2162 (257)
SAP value	96.4949
SAP rating (Section 12)	96 (258)
SAP band	A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	614.9573	0.1557	95.7325 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	349.1130	0.1403	48.9681 (264)
Energy for instantaneous electric shower(s)	738.1451	0.1391	102.6923 (264a)
Space and water heating			144.7006 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	169.3075	0.1443	24.4363 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-975.6718	0.1337	-130.4502
PV Unit electricity exported	-1373.9222	0.1221	-167.8175
Total			-298.2677 (269)
Total CO2, kg/year			-26.4385 (272)
CO2 emissions per m2			-0.3600 (273)
EI value			100.3000
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

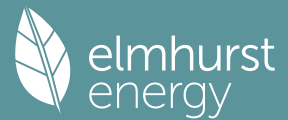
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	37.2600 (1b)	x 2.5500 (2b)	= 95.0130 (1b) - (3b)
First floor	35.8200 (1c)	x 2.4200 (2c)	= 86.6844 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	181.6974 (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	3 * 10 = 30.0000 (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) =	30.0000 / (5) = 0.1651 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4151 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3840 (21)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

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Wind speed	4.2000	4.0000	4.0000	3.7000	3.8000	3.5000	3.6000	3.4000	3.7000	3.5000	4.0000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9500	0.8750	0.9000	0.8500	0.8500	0.9250	1.0000	(22a)
Adj infilt rate												
	0.4032	0.3840	0.3840	0.3552	0.3648	0.3360	0.3456	0.3264	0.3264	0.3552	0.3360	(22b)
Effective ac	0.5813	0.5737	0.5737	0.5631	0.5665	0.5564	0.5597	0.5533	0.5533	0.5631	0.5564	(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								
Solid Door			1.7900	1.0000	1.7900			(26)
Window			11.1900	1.1450	12.8130			(27)
Ground Floor			37.2600	0.1300	4.8438	135.0000	5030.1000	(28a)
External Walls	86.2600	12.9800	73.2800	0.1800	13.1904	55.5000	4067.0400	(29a)
Pitched Roof, Flat Ceiling	35.8200		35.8200	0.1100	3.9402	8.8000	315.2160	(30)
Flat Roof	1.4400		1.4400	0.1100	0.1584	8.8000	12.6720	(30)
Total net area of external elements Aum(A, m2)			160.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.7358			(33)
Main dwelling								
Party Wall			50.4700	0.0000	0.0000	55.5000	2801.0850	(32)
Internal Walls			94.1700			8.8000	828.6960	(32c)
Internal Floor			35.8200			17.6000	630.4320	(32d)
Internal Ceiling			35.8200			8.8000	315.2160	(32e)

Heat capacity Cm = Sum(A x k)

(28)...(30) + (32) + (32a)...(32e) = 14000.4570 (34)

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

191.5771 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	7.9500	0.2140	1.7013	
E3 Sill	4.2000	0.0200	0.0840	
E4 Jamb	15.7200	0.0150	0.2358	
E5 Ground floor (normal)	17.5500	0.0510	0.8951	
P1 Party wall - Ground floor	10.3500	0.0360	0.3726	
E6 Intermediate floor within a dwelling	13.5500	0.0010	0.0136	
E24 Eaves (insulation at ceiling level - inverted)	3.6000	0.1500	0.5400	
P2 Party wall - Intermediate floor within a dwelling	9.9500	0.0000	0.0000	
E14 Flat roof	4.4000	0.1600	0.7040	
E10 Eaves (insulation at ceiling level)	17.1500	0.0560	0.9604	
P4 Party wall - Roof (insulation at ceiling level)	9.9500	0.0330	0.3283	
E16 Corner (normal)	9.9400	0.0380	0.3777	
E18 Party wall between dwellings	9.9400	0.0400	0.3976	

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

6.6104 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 43.3461 (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	34.8533	34.4003	34.4003	33.7621	33.9693	33.3643	33.5604	33.1737	33.1737	33.7621	33.3643	34.4003	(38)
Average = Sum(39)m / 12 =	78.1995	77.7464	77.7464	77.1083	77.3154	76.7104	76.9066	76.5198	76.5198	77.1083	76.7104	77.7464	(39)
												77.1948	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0701	1.0639	1.0639	1.0551	1.0580	1.0497	1.0524	1.0471	1.0471	1.0551	1.0497	1.0639	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.0563	
												31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3185	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	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	(42b)
Hot water usage for other uses	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740	(42c)	
Average daily hot water use (litres/day)													34.8854	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	38.3740	36.9785	35.5831	34.1877	32.7923	31.3969	31.3969	32.7923	34.1877	35.5831	36.9785	38.3740	(44)	
Energy content (annual)	60.7750	52.6569	54.6899	46.8013	44.1447	38.6061	37.9718	40.6037	42.1569	48.2860	52.6827	60.0843	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		579.4593		
	9.1162	7.8985	8.2035	7.0202	6.6217	5.7909	5.6958	6.0906	6.3235	7.2429	7.9024	9.0127	(46)	
Water storage loss (or HIU loss):														
Store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2100	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.6534	(55)
Total storage loss														
	20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	(56)	
If cylinder contains dedicated solar storage														
	20.2554	18.2952	20.2554	19.6020	20.2554	19.6020	20.2554	20.2554	19.6020	20.2554	19.6020	20.2554	(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														
	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)	
Output from w/h														
	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021	(64)	
Electric shower(s)														
	64.8922	57.8195	63.1367	60.2505	61.3811	58.5516	60.5034	61.3811	60.2505	63.1367	61.9495	64.8922	(64a)	
										Total per year (kWh/year) = Sum(64a)m =		1091.8463	(64)	
Heat gains from water heating, kWh/month														
	71.2450	63.4084	68.7828	64.3153	64.8376	61.1656	62.5657	63.6603	62.7710	66.6535	66.6956	71.0153	(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	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111	139.1111 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.9672	21.2875	17.3121	13.1064	9.7972	8.2712	8.9373	11.6171	15.5924	19.7981	23.1074	24.6333 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.0392	308.2045	300.2279	283.2467	261.8110	241.6645	228.2053	225.0400	233.0165	249.9978	271.4335	291.5800 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296	51.2296 (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)	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408	-92.7408 (71)
Water heating gains (Table 5)	95.7594	94.3578	92.4500	89.3267	87.1474	84.9523	84.0937	85.5649	87.1819	89.5880	92.6327	95.4507 (72)
Total internal gains	522.3658	521.4498	507.5901	483.2799	456.3556	432.4879	418.8363	419.8219	433.3909	456.9839	484.7736	509.2641 (73)

6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.8600		12.3661		0.4500		0.0000		0.7700		33.6790	(74)
South	3.3300		52.5273		0.4500		0.0000		0.7700		60.6083	(78)
Solar gains	94.2874	142.7777	206.3998	288.1599	340.5754	375.0773	352.2246	307.3419	250.1734	173.7590	109.5831	77.0761 (83)
Total gains	616.6531	664.2275	713.9899	771.4398	796.9310	807.5652	771.0610	727.1638	683.5643	630.7430	594.3566	586.3402 (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	49.7320	50.0218	50.0218	50.4358	50.3006	50.6974	50.5681	50.8236	50.8236	50.4358	50.6974	50.0218
alpha	4.3155	4.3348	4.3348	4.3624	4.3534	4.3798	4.3712	4.3882	4.3882	4.3624	4.3798	4.3348
util living area	0.9744	0.9622	0.9294	0.8432	0.6798	0.4303	0.2588	0.2937	0.5853	0.8541	0.9542	0.9784 (86)
Living	19.8373	20.0045	20.3062	20.6650	20.9016	20.9902	20.9993	20.9987	20.9617	20.7005	20.2226	19.7989
Non living	18.7035	18.9164	19.2887	19.7161	19.9610	20.0380	20.0398	20.0441	20.0229	19.7648	19.2002	18.6593
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4052	20.0045	20.3062	20.6650	20.9016	20.9902	20.9993	20.9987	20.9617	20.7005	20.2226	19.9669 (87)
Th 2	20.0254	20.0305	20.0305	20.0377	20.0353	20.0421	20.0399	20.0443	20.0443	20.0377	20.0421	20.0305 (88)
util rest of house	0.9682	0.9532	0.9122	0.8066	0.6139	0.3438	0.1635	0.1940	0.4955	0.8114	0.9415	0.9731 (89)
MIT 2	19.4984	18.9164	19.2887	19.7161	19.9610	20.0380	20.0398	20.0441	20.0229	19.7648	19.2002	18.9064 (90)
Living area fraction									fLA = Living area / (4) =			0.4298 (91)
MIT	19.8881	19.3841	19.7260	20.1239	20.3653	20.4472	20.4522	20.4544	20.4264	20.1669	19.6396	19.3622 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8881	19.3841	19.7260	20.1239	20.3653	20.4472	20.4522	20.4544	20.4264	20.1669	19.6396	19.3622 (93)

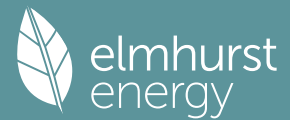
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9672	0.9457	0.9059	0.8102	0.6374	0.3808	0.2045	0.2369	0.5326	0.8178	0.9350	0.9685 (94)
Useful gains	596.4125	628.1701	646.8043	625.0257	507.9979	307.5446	157.7051	172.2664	364.0342	515.8162	555.7058	567.8486 (95)
Ext temp.	5.2000	5.8000	7.6000	10.2000	13.3000	16.4000	18.4000	18.2000	15.5000	11.9000	8.1000	5.2000 (96)
Heat loss rate W	1148.6054	1056.1132	942.7535	765.2171	546.2545	310.4652	157.8274	172.5049	376.9702	637.4480	885.2079	1101.0596 (97)
Space heating kWh	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98a)
Space heating requirement - total per year (kWh/year)												1772.4407
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	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1772.4407
Space heating per m ²										(98c) / (4) =		24.2534 (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 %)												361.8965 (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	410.8315	287.5777	220.1862	100.9379	28.4629	0.0000	0.0000	0.0000	0.0000	90.4941	237.2415	396.7090 (98)
Space heating efficiency (main heating system 1)	361.8965	361.8965	361.8965	361.8965	361.8965	0.0000	0.0000	0.0000	0.0000	361.8965	361.8965	361.8965 (210)
Space heating fuel (main heating system)	113.5218	79.4641	60.8423	27.8914	7.8649	0.0000	0.0000	0.0000	0.0000	25.0055	65.5551	109.6195 (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	104.2928	91.9633	98.2077	88.9153	87.6625	80.7201	81.4896	84.1215	84.2709	91.8038	94.7967	103.6021 (64)	
Efficiency of water heater												313.0123 (216)	
(217)m	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123	313.0123 (217)	
Fuel for water heating, kWh/month	33.3191	29.3801	31.3750	28.4063	28.0061	25.7882	26.0340	26.8748	26.9225	29.3291	30.2853	33.0984 (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	20.9784	16.8296	15.1532	11.1019	8.5754	7.0062	7.8228	10.1684	13.2077	17.3292	19.5733	21.5614 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.0920	-60.2925	-93.6625	-111.1284	-118.9022	-114.1889	-112.6194	-105.8734	-91.3113	-73.6762	-47.9242	-35.9515 (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	-19.5518	-39.1597	-92.0134	-166.1020	-230.6266	-259.9643	-249.9975	-205.2640	-137.4178	-69.0294	-26.5731	-14.0133 (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												489.7645 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												313.0123	
Water heating fuel used												348.8189 (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)												169.3075 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2519.3354 (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												-773.2994 (238)	

10a. Fuel costs - using BEDF prices (596)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	489.7645	27.6700	135.5178 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	348.8189	27.6700	96.5182 (247)	
Energy for instantaneous electric shower(s)	738.1451	27.6700	204.2447 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Energy for lighting	169.3075	27.6700	46.8474 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.6225	27.6700	-279.3626	
PV Unit electricity exported	-1509.7129	5.8100	-87.7143	
Total			-367.0769 (252)	
Total energy cost			116.0513 (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	489.7645	0.1566	76.7214 (261)	
Total CO2 associated with community systems			0.0000 (373)	
Water heating (other fuel)	348.8189	0.1403	48.9269 (264)	
Energy for instantaneous electric shower(s)	738.1451	0.1391	102.6923 (264a)	
Space and water heating			125.6482 (265)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)	
Energy for lighting	169.3075	0.1443	24.4363 (268)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.6225	0.1338	-135.0684	
PV Unit electricity exported	-1509.7129	0.1219	-184.0783	
Total			-319.1468 (269)	
Total CO2, kg/year			-66.3699 (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	489.7645	1.5799	773.7906 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	348.8189	1.5186	529.7213 (278)	
Energy for instantaneous electric shower(s)	738.1451	1.5143	1117.7983 (278a)	
Space and water heating			1303.5119 (279)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)	
Energy for lighting	169.3075	1.5338	259.6895 (282)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1009.6225	1.4944	-1508.7681	
PV Unit electricity exported	-1509.7129	0.4473	-675.3187	
Total			-2184.0868 (283)	
Total Primary energy kWh/year			496.9128 (286)	

