

Full SAP Calculation Printout



Property Reference	P22691(6) Mount P				Issued on Date	24/02/2023
Assessment Reference	P22691(6)		Prop Type Ref			
Property	New House 6, 40-48, Mount Pleasant, Reading, RG1 2TF					
SAP Rating	83 B	DER	3.70	TER	11.97	
Environmental	97 A	% DER < TER			69.09	
CO ₂ Emissions (t/year)	0.37	DFEE	41.50	TFEE	42.36	
Compliance Check	See BREL	% DFEE < TFEE			2.03	
% DPER < TPER	38.08	DPER	38.83	TPER	62.71	
Assessor Details	Mr. Malcolm Lisle				Assessor ID	P736-0001
Client	Mount P, Jay Zaman					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b)	-
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c)	-
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.8230	(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)

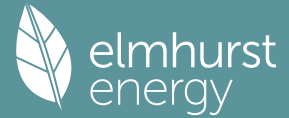
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) =	0.1025 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000 (17)	
Infiltration rate		0.3025 (18)	
Number of sides sheltered		1 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2798 (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	0.3567	0.3497	0.3427	0.3077	0.3007	0.2658	0.2658	0.2588	0.2798	0.3007	0.3147	0.3287 (22b)
Effective ac	0.5636	0.5611	0.5587	0.5474	0.5452	0.5353	0.5353	0.5335	0.5391	0.5452	0.5495	0.5540 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)

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Total net area of external elements Aum(A, m2)	231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	69.5545			(33)
Party Wall 1	54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber	111.2600			9.0000	1001.3400 (32c)
Internal Floor - 1st Floor	39.8900			18.0000	718.0200 (32d)
Internal Floor - 2nd Floor	25.6400			18.0000	461.5200 (32d)
Internal Ceiling - G Floor	29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor	17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12006.7500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 111.5869 (35)

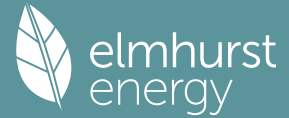
List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E1 Steel lintel with perforated steel base plate	17.0000	0.0580	0.9860		
E3 Sill	11.6000	0.0450	0.5220		
E4 Jamb	46.6000	0.0500	2.3300		
E5 Ground floor (normal)	19.8000	0.0550	1.0890		
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000		
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728		
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624		
E15 Flat roof with parapet	7.0000	0.3000	2.1000		
E16 Corner (normal)	12.1000	0.0440	0.5324		
E18 Party wall between dwellings	2.5000	0.0370	0.0925		
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402		
P1 Party wall - Ground floor	7.6000	0.0490	0.3724		
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000		
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541		
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040		
R1 Head of roof window	3.1000	0.2400	0.7440		
R2 Sill of roof window	3.1000	0.2400	0.7440		
R3 Jamb of roof window	4.8000	0.2400	1.1520		
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760		
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				15.0463	(36)
Point Thermal bridges				0.0000	
Total fabric heat loss				(33) + (36) + (36a) =	84.6008 (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	54.4634	54.2246	53.9906	52.8916	52.6860	51.7287	51.7287	51.5515	52.0975	52.6860	53.1020	53.5369	(38)
Average = Sum(39)m / 12 =	139.0641	138.8254	138.5914	137.4924	137.2868	136.3295	136.3295	136.1523	136.6982	137.2868	137.7027	138.1376	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2924	1.2902	1.2880	1.2778	1.2759	1.2670	1.2670	1.2654	1.2704	1.2759	1.2798	1.2838	(40)
HLP (average)												1.2778	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7996	(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	86.3998	85.1167	83.3097	79.9780	77.4833	74.7170	73.2228	75.0171	76.9708	79.9308	83.3311	86.1077	86.1077	(42b)
Hot water usage for other uses	45.5800	43.9225	42.2651	40.6076	38.9502	37.2927	37.2927	38.9502	40.6076	42.2651	43.9225	45.5800	45.5800	(42c)
Average daily hot water use (litres/day)													121.5426	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	131.9798	129.0392	125.5748	120.5856	116.4334	112.0097	110.5155	113.9673	117.5784	122.1958	127.2536	131.6877	131.6877	(44)
Energy content (annual)	209.0237	183.7501	193.0037	165.0757	156.7418	137.7290	133.6589	141.1153	144.9859	165.8186	181.2961	206.1911	206.1911	(45)
Distribution loss (46)m = 0.15 x (45)m	31.3536	27.5625	28.9506	24.7613	23.5113	20.6593	20.0488	21.1673	21.7479	24.8728	27.1944	30.9287	30.9287	(46)
Water storage loss:													150.0000	(47)
Store volume													1.8600	(48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400	(49)
Temperature factor from Table 2b													1.0044	(55)
Enter (49) or (54) in (55)														
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	260.5899	(62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	260.5899	(64)
12Total per year (kWh/year)													2658.8918	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000	(64a)

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Heat gains from water heating, kWh/month
 113.0194 100.4044 107.6928 97.0029 95.6357 87.9101 87.9606 90.4399 90.3230 98.6537 102.3962 112.0776 (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	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2063	149.6927	135.2063	139.7132	135.2063	139.7132	135.2063	135.2063	139.7132	135.2063	139.7132	135.2063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.0617	270.8433	263.8337	248.9110	230.0737	212.3694	200.5418	197.7602	204.7698	219.6925	238.5297	256.2341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	(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)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	(71)
Water heating gains (Table 5)	151.9078	149.4113	144.7484	134.7262	128.5426	122.0973	118.2266	121.5590	125.4486	132.5991	142.2169	150.6419	(72)
Total internal gains	620.1702	634.9418	608.7828	588.3448	558.8170	539.1743	518.9692	519.5198	534.9260	552.4923	585.4542	607.0767	(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	9.6400	10.6334	0.6300	0.7000	0.7700	31.3271 (74)
Southeast	14.2100	36.7938	0.6300	0.7000	0.7700	159.7868 (77)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739 (78)
East	4.0600	26.2379	0.6300	0.7000	1.0000	42.2802 (82)

Solar gains	336.2680	585.3933	834.0048	1088.0484	1268.0958	1280.5136	1225.5780	1088.0450	921.5254	655.9359	405.0775	286.2775	(83)
Total gains	956.4383	1220.3350	1442.7876	1676.3932	1826.9129	1819.6879	1744.5471	1607.5649	1456.4514	1208.4282	990.5318	893.3543	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	23.9832	24.0245	24.0650	24.2574	24.2937	24.4643	24.4643	24.4962	24.3983	24.2937	24.2203	24.1441	
alpha	2.5989	2.6016	2.6043	2.6172	2.6196	2.6310	2.6310	2.6331	2.6266	2.6196	2.6147	2.6096	
util living area	0.9388	0.8940	0.8293	0.7208	0.5856	0.4407	0.3300	0.3691	0.5557	0.7810	0.9050	0.9474	(86)
Living	19.0730	19.4281	19.8483	20.3020	20.6189	20.7933	20.8526	20.8414	20.7122	20.2653	19.5853	19.0050	
Non living	17.6205	18.0615	18.5762	19.1185	19.4722	19.6534	19.7024	19.6968	19.5820	19.0958	18.2721	17.5402	
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	20.0142	19.4281	19.8483	20.3020	20.6189	20.7933	20.8526	20.8414	20.7122	20.2653	19.5853	19.2841	(87)
Th 2	19.8468	19.8485	19.8502	19.8583	19.8598	19.8668	19.8668	19.8681	19.8641	19.8598	19.8567	19.8535	(88)
util rest of house	0.9293	0.8786	0.8054	0.6839	0.5338	0.3732	0.2500	0.2854	0.4856	0.7418	0.8884	0.9391	(89)
MIT 2	18.9592	18.0615	18.5762	19.1185	19.4722	19.6534	19.7024	19.6968	19.5820	19.0958	18.2721	17.9571	(90)
Living area fraction									fLA = Living area / (4) =			0.3226	(91)
MIT	19.2996	18.5023	18.9865	19.5003	19.8421	20.0211	20.0734	20.0661	19.9466	19.4730	18.6957	18.3852	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2996	18.5023	18.9865	19.5003	19.8421	20.0211	20.0734	20.0661	19.9466	19.4730	18.6957	18.3852	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9240	0.8566	0.7846	0.6712	0.5329	0.3827	0.2650	0.3005	0.4910	0.7266	0.8675	0.9256	(94)
Useful gains	883.7890	1045.3783	1132.0535	1125.2422	973.6468	696.4410	462.2659	483.0912	715.1155	878.0653	859.2574	826.8614	(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	2085.9006	1888.3519	1730.5274	1457.4576	1117.8054	739.0621	473.5286	499.1441	799.2224	1218.1482	1596.7624	1959.5038	(97)
Space heating kWh	894.3711	566.4783	445.2645	239.1951	107.2540	0.0000	0.0000	0.0000	0.0000	253.0216	531.0036	842.6859	(98a)
Space heating requirement - total per year (kWh/year)												3879.2742	
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	894.3711	566.4783	445.2645	239.1951	107.2540	0.0000	0.0000	0.0000	0.0000	253.0216	531.0036	842.6859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3879.2742	
Space heating per m ²										(98c) / (4) =		36.0527	(99)

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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 %)													364.3775 (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	894.3711	566.4783	445.2645	239.1951	107.2540	0.0000	0.0000	0.0000	0.0000	253.0216	531.0036	842.6859	(98)
Space heating efficiency (main heating system 1)	364.3775	364.3775	364.3775	364.3775	364.3775	0.0000	0.0000	0.0000	0.0000	364.3775	364.3775	364.3775	(210)
Space heating fuel (main heating system)	245.4518	155.4647	122.1987	65.6449	29.4349	0.0000	0.0000	0.0000	0.0000	69.4394	145.7290	231.2673	(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	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	(64)
Efficiency of water heater													
(217)m	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	(216)
Fuel for water heating, kWh/month	141.1228	124.7627	132.5405	116.6385	113.1139	101.9881	100.7478	104.7424	105.8759	117.9767	125.3283	139.6053	(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	26.8508	21.5407	19.3950	14.2096	10.9759	8.9674	10.0126	13.0148	16.9049	22.1801	25.0524	27.5971	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1													1064.6306 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													186.6619
Water heating fuel used													1424.4430 (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)													216.7015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													2705.7751 (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	1064.6306	0.1559	165.9974 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1424.4430	0.1409	200.6488 (264)
Space and water heating			366.6462 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	216.7015	0.1443	31.2767 (268)
Total CO2, kg/year			397.9229 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7000 (273)

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

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	Energy kWh/year	Primary energy kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1064.6306	1.5772	1679.1182 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1424.4430	1.5209	2166.3664 (278)
Space and water heating			3845.4846 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	216.7015	1.5338	332.3840 (282)
Total Primary energy kWh/year			4177.8686 (286)
Dwelling Primary energy Rate (DPER)			38.8300 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.8230 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1366 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3866	(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) =	0.3576 (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	0.4559	0.4470	0.4381	0.3934	0.3844	0.3397	0.3397	0.3308	0.3576	0.3844	0.4023	0.4202 (22b)
Effective ac	0.6039	0.5999	0.5960	0.5774	0.5739	0.5577	0.5577	0.5547	0.5639	0.5739	0.5809	0.5883 (25)

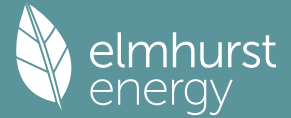
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			23.7900	1.1450	27.2405		(27)
Rooflights			3.1100	1.5038	4.6767		(27a)
Ground Floor			38.0700	0.1300	4.9491		(28a)
External Wall	145.6000	23.7900	121.8100	0.1800	21.9258		(29a)
External Roof - Sloping	33.4700	3.1100	30.3600	0.1100	3.3396		(30)
External Roof - Flat Roof	14.2500		14.2500	0.1100	1.5675		(30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.6991		(33)
Party Wall 1			54.1200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 111.5869 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	17.0000	0.0500	0.8500
E1 Steel lintel with perforated steel base plate			

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E3 Sill	11.6000	0.0500	0.5800									
E4 Jamb	46.6000	0.0500	2.3300									
E5 Ground floor (normal)	19.8000	0.1600	3.1680									
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000									
E11 Eaves (insulation at rafter level)	4.8000	0.0400	0.1920									
E13 Gable (insulation at rafter level)	9.6000	0.0800	0.7680									
E15 Flat roof with parapet	7.0000	0.5600	3.9200									
E16 Corner (normal)	12.1000	0.0900	1.0890									
E18 Party wall between dwellings	2.5000	0.0600	0.1500									
E25 Staggered party wall between dwellings	14.6000	0.0600	0.8760									
P1 Party wall - Ground floor	7.6000	0.0800	0.6080									
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000									
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.1200	0.3960									
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.0800	0.3840									
R1 Head of roof window	3.1000	0.0800	0.2480									
R2 Sill of roof window	3.1000	0.0600	0.1860									
R3 Jamb of roof window	4.8000	0.0800	0.3840									
R4 Ridge (vaulted ceiling)	4.8000	0.0800	0.3840									
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0900	-0.2250									
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				16.2880 (36)								
Point Thermal bridges				0.0000								
Total fabric heat loss		(33) + (36) + (36a) =		79.9871 (37)								
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.3601	Feb 57.9701	Mar 57.5878	Apr 55.7921	May 55.4561	Jun 53.8921	Jul 53.8921	Aug 53.6025	Sep 54.4945	Oct 55.4561	Nov 56.1357	Dec 56.8463 (38)
Heat transfer coeff	138.3472	137.9572	137.5749	135.7792	135.4432	133.8792	133.8792	133.5896	134.4817	135.4432	136.1229	136.8335 (39)
Average = Sum(39)m / 12 =												135.7776
HLP	Jan 1.2858	Feb 1.2821	Mar 1.2786	Apr 1.2619	May 1.2588	Jun 1.2442	Jul 1.2442	Aug 1.2415	Sep 1.2498	Oct 1.2588	Nov 1.2651	Dec 1.2717 (40)
HLP (average)												1.2619
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7996 (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	82.0798	80.8608	79.1442	75.9791	73.6091	70.9811	69.5616	71.2662	73.1222	75.9342	79.1645	81.8023 (42b)
Hot water usage for other uses	43.3010	41.7264	40.1518	38.5772	37.0026	35.4281	35.4281	37.0026	38.5772	40.1518	41.7264	43.3010 (42c)
Average daily hot water use (litres/day)												115.4654 (43)
Daily hot water use	Jan 125.3808	Feb 122.5872	Mar 119.2960	Apr 114.5563	May 110.6117	Jun 106.4092	Jul 104.9897	Aug 108.2689	Sep 111.6995	Oct 116.0861	Nov 120.8909	Dec 125.1033 (44)
Energy conte	198.5725	174.5626	183.3535	156.8219	148.9047	130.8425	126.9760	134.0595	137.7366	157.5277	172.2313	195.8815 (45)
Energy content (annual)										Total = Sum(45)m =		1917.4703
Distribution loss (46)m = 0.15 x (45)m	29.7859	26.1844	27.5030	23.5233	22.3357	19.6264	19.0464	20.1089	20.6605	23.6292	25.8347	29.3822 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	245.1674	216.6483	229.9484	201.9137	195.4996	175.9344	173.5709	180.6544	182.8285	204.1226	217.3231	242.4764 (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	245.1674	216.6483	229.9484	201.9137	195.4996	175.9344	173.5709	180.6544	182.8285	204.1226	217.3231	242.4764 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2466.0877 (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	103.3013	91.7106	98.2410	88.2167	86.7867	79.5786	79.4954	81.8507	81.8709	89.6539	93.3404	102.4065 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 139.9813	Feb 139.9813	Mar 139.9813	Apr 139.9813	May 139.9813	Jun 139.9813	Jul 139.9813	Aug 139.9813	Sep 139.9813	Oct 139.9813	Nov 139.9813	Dec 139.9813 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2063	149.6927	135.2063	139.7132	135.2063	139.7132	135.2063	135.2063	139.7132	135.2063	139.7132	135.2063 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	268.0617	270.8433	263.8337	248.9110	230.0737	212.3694	200.5418	197.7602	204.7698	219.6925	238.5297	256.2341 (68)
Pumps, fans	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851 (71)
Total internal gains	138.8458	136.4741	132.0443	122.5233	116.6488	110.5259	106.8487	110.0144	113.7096	120.5025	129.6394	137.6432 (72)
	610.1082	625.0046	599.0787	579.1418	549.9233	527.6028	507.5912	507.9753	523.1870	543.3958	575.8768	597.0780 (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	7.3800	10.6334	0.6300	0.7000	0.7700	23.9828 (74)
Southeast	10.8900	36.7938	0.6300	0.7000	0.7700	122.4545 (77)
South	5.5200	46.7521	0.6300	0.7000	0.7700	78.8700 (78)
East	3.1100	26.2379	0.6300	0.7000	1.0000	32.3870 (82)

Solar gains	257.6943	448.5965	639.0822	833.7040	971.6228	981.1204	939.0360	833.6858	706.1316	502.6465	310.4234	219.3862 (83)
Total gains	867.8026	1073.6011	1238.1609	1412.8458	1521.5461	1508.7232	1446.6272	1341.6611	1229.3186	1046.0423	886.3002	816.4642 (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	24.1075	24.1757	24.2429	24.5635	24.6244	24.9121	24.9121	24.9661	24.8005	24.6244	24.5014	24.3742
alpha	2.6072	2.6117	2.6162	2.6376	2.6416	2.6608	2.6608	2.6644	2.6534	2.6416	2.6334	2.6249
util living area	0.9499	0.9166	0.8675	0.7773	0.6539	0.5056	0.3842	0.4251	0.6182	0.8228	0.9230	0.9564 (86)
MIT	18.4781	18.8982	19.4339	20.0686	20.5471	20.8384	20.9429	20.9241	20.7117	20.0622	19.1654	18.4126 (87)
Th 2	19.8520	19.8549	19.8577	19.8708	19.8733	19.8848	19.8848	19.8869	19.8803	19.8733	19.8683	19.8631 (88)
util rest of house	0.9419	0.9038	0.8473	0.7440	0.6028	0.4335	0.2950	0.3334	0.5475	0.7880	0.9089	0.9493 (89)
MIT 2	16.9465	17.4724	18.1364	18.9088	19.4565	19.7669	19.8560	19.8460	19.6508	18.9251	17.8246	16.8706 (90)
Living area fraction									fLA = Living area / (4) =			0.3226 (91)
MIT	17.4406	17.9324	18.5550	19.2830	19.8083	20.1125	20.2066	20.1938	19.9930	19.2919	18.2571	17.3681 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4406	17.9324	18.5550	19.2830	19.8083	20.1125	20.2066	20.1938	19.9930	19.2919	18.2571	17.3681 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9183	0.8759	0.8192	0.7243	0.5997	0.4490	0.3216	0.3597	0.5552	0.7668	0.8826	0.9274 (94)
Useful gains	796.9179	940.4078	1014.2846	1023.3321	912.4040	677.3468	465.1769	482.5566	682.5396	802.0537	782.2345	757.2005 (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	1817.9631	1797.9113	1658.4619	1409.7910	1098.2162	738.0139	482.8509	506.8081	792.5032	1177.2646	1518.7392	1801.8320 (97)
Space heating kWh	759.6576	576.2423	479.2679	278.2504	138.2443	0.0000	0.0000	0.0000	0.0000	279.1569	530.2834	777.2059 (98a)
Space heating requirement - total per year (kWh/year)												3818.3087
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	759.6576	576.2423	479.2679	278.2504	138.2443	0.0000	0.0000	0.0000	0.0000	279.1569	530.2834	777.2059 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3818.3087
Space heating per m2										(98c) / (4) =		35.4861 (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	759.6576	576.2423	479.2679	278.2504	138.2443	0.0000	0.0000	0.0000	0.0000	279.1569	530.2834	777.2059 (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)	823.0310	624.3145	519.2501	301.4630	149.7771	0.0000	0.0000	0.0000	0.0000	302.4452	574.5216	842.0432 (211)
Space heating efficiency (main heating system 2)												

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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 (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	245.1674	216.6483	229.9484	201.9137	195.4996	175.9344	173.5709	180.6544	182.8285	204.1226	217.3231	242.4764 (64)
Efficiency of water heater	86.4219	86.1453	85.6674	84.7793	83.2970	79.8000	79.8000	79.8000	79.8000	84.7623	85.9811	79.8000 (216)
Fuel for water heating, kWh/month	283.6868	251.4916	268.4201	238.1640	234.7019	220.4691	217.5073	226.3840	229.1083	240.8177	252.7568	86.4807 (217)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	28.0932	22.5374	20.2924	14.8671	11.4838	9.3824	10.4759	13.6170	17.6871	23.2064	26.2116	28.8740 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-37.3321	-53.5458	-78.2798	-89.5445	-97.8275	-91.7229	-90.5424	-84.8235	-74.9847	-61.8646	-41.3467	-32.1656 (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	-18.4099	-39.0041	-78.0050	-118.0142	-156.8358	-157.9148	-156.1089	-131.8626	-96.2003	-56.1020	-24.6803	-14.5417 (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												4136.8459 (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												2943.8899 (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)												226.7283 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1881.7051 (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												5511.7589 (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	4136.8459	0.2100	868.7376 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2943.8899	0.2100	618.2169 (264)
Space and water heating			1486.9545 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	226.7283	0.1443	32.7239 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-833.9799	0.1342	-111.9526
PV Unit electricity exported	-1047.7252	0.1257	-131.6900
Total			-243.6426 (269)
Total CO2, kg/year			1287.9651 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9700 (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	4136.8459	1.1300	4674.6358 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2943.8899	1.1300	3326.5956 (278)
Space and water heating			8001.2315 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	226.7283	1.5338	347.7634 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-833.9799	1.4961	-1247.7216
PV Unit electricity exported	-1047.7252	0.4614	-483.3820
Total			-1731.1036 (283)
Total Primary energy kWh/year			6747.9921 (286)

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Target Primary Energy Rate (TPER)

62.7100 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.8230 (5)

2. Ventilation rate

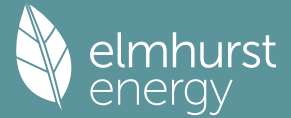
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1366 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3366 (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) = 0.3114 (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	0.3970	0.3892	0.3814	0.3425	0.3347	0.2958	0.2958	0.2880	0.3114	0.3347	0.3503	0.3658 (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	0.5788	0.5757	0.5727	0.5587	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.5545		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			111.2600			9.0000	1001.3400 (32c)
Internal Floor - 1st Floor			39.8900			18.0000	718.0200 (32d)
Internal Floor - 2nd Floor			25.6400			18.0000	461.5200 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12006.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							111.5869 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E1 Steel lintel with perforated steel base plate				17.0000	0.0580	0.9860	
E3 Sill				11.6000	0.0450	0.5220	

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E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.0550	1.0890
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.0463 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 84.6008 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.9300	55.6343	55.3445	53.9833	53.7286	52.5430	52.5430	52.3234	52.9997	53.7286	54.2438	54.7825	(38)
Heat transfer coeff	140.5308	140.2351	139.9453	138.5841	138.3294	137.1438	137.1438	136.9242	137.6004	138.3294	138.8446	139.3832	(39)
Average = Sum(39)m / 12 =												138.5828	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3060	1.3033	1.3006	1.2880	1.2856	1.2746	1.2746	1.2725	1.2788	1.2856	1.2904	1.2954	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

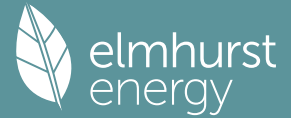
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7996 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.7245	30.2682	29.6256	28.4408	27.5537	26.5700	26.0386	26.6767	27.3715	28.4241	29.6332	30.6206	(42b)
Hot water usage for other uses	43.3010	41.7264	40.1518	38.5772	37.0026	35.4281	35.4281	37.0026	38.5772	40.1518	41.7264	43.3010	(42c)
Average daily hot water use (litres/day)												67.8510	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	74.0255	71.9946	69.7774	67.0181	64.5563	61.9981	61.4667	63.6794	65.9487	68.5759	71.3596	73.9216	(44)
Energy content (annual)	117.2382	102.5193	107.2453	91.7444	86.9052	76.2338	74.3386	78.8483	81.3213	93.0568	101.6649	115.7434	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	99.6525	87.1414	91.1585	77.9827	73.8695	64.7988	63.1879	67.0211	69.1231	79.0983	86.4151	98.3819	(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	99.6525	87.1414	91.1585	77.9827	73.8695	64.7988	63.1879	67.0211	69.1231	79.0983	86.4151	98.3819	(64)
12Total per year (kWh/year)													
Electric shower(s)	56.9876	50.7764	55.4459	52.9113	53.9042	51.4194	53.1333	53.9042	52.9113	55.4459	54.4033	56.9876	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												648.2302	(64a)
Heat gains from water heating, kWh/month	39.1600	34.4795	36.6511	32.7235	31.9434	29.0545	29.0803	30.2313	30.5086	33.6360	35.2046	38.8424	(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	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	139.9813	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2063	149.6927	135.2063	139.7132	135.2063	139.7132	135.2063	135.2063	139.7132	135.2063	139.7132	135.2063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.0617	270.8433	263.8337	248.9110	230.0737	212.3694	200.5418	197.7602	204.7698	219.6925	238.5297	256.2341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	(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)													

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	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	(71)
Water heating gains (Table 5)	52.6344	51.3087	49.2622	45.4493	42.9347	40.3535	39.0864	40.6335	42.3731	45.2097	48.8953	52.2075	(72)
Total internal gains	520.8969	536.8392	513.2966	499.0679	473.2092	457.4305	439.8289	438.5944	451.8505	465.1030	492.1326	508.6423	(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	9.6400	10.6334	0.6300		0.7000		0.7700	31.3271 (74)
Southeast	14.2100	36.7938	0.6300		0.7000		0.7700	159.7868 (77)
South	7.2000	46.7521	0.6300		0.7000		0.7700	102.8739 (78)
East	4.0600	26.2379	0.6300		0.7000		1.0000	42.2802 (82)

Solar gains	336.2680	585.3933	834.0048	1088.0484	1268.0958	1280.5136	1225.5780	1088.0450	921.5254	655.9359	405.0775	286.2775	(83)
Total gains	857.1649	1122.2324	1347.3015	1587.1163	1741.3050	1737.9441	1665.4069	1526.6394	1373.3758	1121.0389	897.2102	794.9198	(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	23.7329	23.7830	23.8322	24.0663	24.1106	24.3191	24.3191	24.3581	24.2384	24.1106	24.0212	23.9283	
alpha	2.5822	2.5855	2.5888	2.6044	2.6074	2.6213	2.6213	2.6239	2.6159	2.6074	2.6014	2.5952	
util living area	0.9516	0.9102	0.8488	0.7421	0.6069	0.4595	0.3458	0.3878	0.5810	0.8058	0.9221	0.9591	(86)
MIT	18.4177	18.9131	19.5040	20.1537	20.6102	20.8652	20.9530	20.9356	20.7424	20.0916	19.1315	18.3280	(87)
Th 2	19.8361	19.8382	19.8404	19.8503	19.8521	19.8608	19.8608	19.8624	19.8575	19.8521	19.8484	19.8445	(88)
util rest of house	0.9437	0.8965	0.8266	0.7062	0.5547	0.3899	0.2622	0.3004	0.5098	0.7688	0.9078	0.9524	(89)
MIT 2	17.5182	18.0005	18.5679	19.1774	19.5776	19.7860	19.8429	19.8361	19.7009	19.1427	18.2291	17.4359	(90)
Living area fraction	17.8084	18.2949	18.8699	19.4924	19.9107	20.1341	20.2010	20.1908	20.0369	19.4488	18.5202	17.7237	(92)
MIT	17.8084	18.2949	18.8699	19.4924	19.9107	20.1341	20.2010	20.1908	20.0369	19.4488	18.5202	17.7237	(93)
Temperature adjustment												0.0000	
adjusted MIT	17.8084	18.2949	18.8699	19.4924	19.9107	20.1341	20.2010	20.1908	20.0369	19.4488	18.5202	17.7237	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9253	0.8738	0.8047	0.6938	0.5575	0.4072	0.2878	0.3265	0.5217	0.7538	0.8867	0.9356	(94)
Useful gains	793.1207	980.6380	1084.1552	1101.1567	970.8584	707.6872	479.3228	498.4380	716.5276	844.9959	795.5866	743.7236	(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	1898.3449	1878.4366	1731.1045	1467.9325	1135.7847	758.9700	493.8565	519.0542	816.9132	1224.0528	1585.6297	1884.9725	(97)
Space heating kWh	822.2868	603.3207	481.3303	264.0786	122.7052	0.0000	0.0000	0.0000	0.0000	282.0183	568.8311	849.0892	(98a)
Space heating requirement - total per year (kWh/year)												3993.6601	
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	822.2868	603.3207	481.3303	264.0786	122.7052	0.0000	0.0000	0.0000	0.0000	282.0183	568.8311	849.0892	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3993.6601	
Space heating per m2										(98c) / (4) =		37.1158	(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	1289.1514	1014.8638	1040.6240	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8496	0.8942	0.8707	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1095.2488	907.5418	906.0909	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1927.7358	1848.1407	1696.0237	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	599.3906	699.8056	587.7100	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	149.8477	174.9514	146.9275	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												471.7266	(107)
Energy for space heating												37.1158	(99)
Energy for space cooling												4.3841	(108)
Total												41.4999	(109)

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Fabric Energy Efficiency (DFEE)

41.5 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.8230 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1366 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000 (17)	
Infiltration rate	0.3866 (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) =	0.3576 (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	0.4559	0.4470	0.4381	0.3934	0.3844	0.3397	0.3397	0.3308	0.3576	0.3844	0.4023	0.4202 (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	0.6039	0.5999	0.5960	0.5774	0.5739	0.5577	0.5577	0.5547	0.5639	0.5739	0.5809	0.5883 (25)

3. Heat losses and heat loss parameter

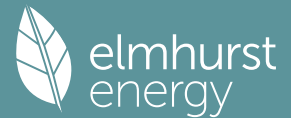
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.20)			23.7900	1.1450	27.2405		(27)
Rooflights			3.1100	1.5038	4.6767		(27a)
Ground Floor			38.0700	0.1300	4.9491		(28a)
External Wall	145.6000	23.7900	121.8100	0.1800	21.9258		(29a)
External Roof - Sloping	33.4700	3.1100	30.3600	0.1100	3.3396		(30)
External Roof - Flat Roof	14.2500		14.2500	0.1100	1.5675		(30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.6991		(33)
Party Wall 1			54.1200	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 111.5869 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	17.0000	0.0500	0.8500
E3 Sill	11.6000	0.0500	0.5800
E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.1600	3.1680
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0400	0.1920
E13 Gable (insulation at rafter level)	9.6000	0.0800	0.7680
E15 Flat roof with parapet	7.0000	0.5600	3.9200

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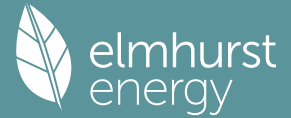
E16 Corner (normal)														12.1000	0.0900	1.0890	
E18 Party wall between dwellings														2.5000	0.0600	0.1500	
E25 Staggered party wall between dwellings														14.6000	0.0600	0.8760	
P1 Party wall - Ground floor														7.6000	0.0800	0.6080	
P2 Party wall - Intermediate floor within a dwelling														13.2000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)														3.3000	0.1200	0.3960	
P5 Party wall - Roof (insulation at rafter level)														4.8000	0.0800	0.3840	
R1 Head of roof window														3.1000	0.0800	0.2480	
R2 Sill of roof window														3.1000	0.0600	0.1860	
R3 Jamb of roof window														4.8000	0.0800	0.3840	
R4 Ridge (vaulted ceiling)														4.8000	0.0800	0.3840	
E17 Corner (inverted - internal area greater than external area)														2.5000	-0.0900	-0.2250	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)																	16.2880 (36)
Point Thermal bridges																	(36a) = 0.0000
Total fabric heat loss																	(33) + (36) + (36a) = 79.9871 (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					(38)
Heat transfer coeff	58.3601	57.9701	57.5878	55.7921	55.4561	53.8921	53.8921	53.6025	54.4945	55.4561	56.1357	56.8463					
Average = Sum(39)m / 12 =	138.3472	137.9572	137.5749	135.7792	135.4432	133.8792	133.8792	133.5896	134.4817	135.4432	136.1229	136.8335					(39) 135.7776
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					(40)
HLP (average)	1.2858	1.2821	1.2786	1.2619	1.2588	1.2442	1.2442	1.2415	1.2498	1.2588	1.2651	1.2717					1.2619
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31					

4. Water heating energy requirements (kWh/year)																	

Assumed occupancy																	2.7996 (42)
Hot water usage for mixer showers																	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					(42a)
Hot water usage for baths																	
	30.7245	30.2682	29.6256	28.4408	27.5537	26.5700	26.0386	26.6767	27.3715	28.4241	29.6332	30.6206					(42b)
Hot water usage for other uses																	
	43.3010	41.7264	40.1518	38.5772	37.0026	35.4281	35.4281	37.0026	38.5772	40.1518	41.7264	43.3010					(42c)
Average daily hot water use (litres/day)																	67.8510 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	74.0255	71.9946	69.7774	67.0181	64.5563	61.9981	61.4667	63.6794	65.9487	68.5759	71.3596	73.9216					(44)
Energy conte	117.2382	102.5193	107.2453	91.7444	86.9052	76.2338	74.3386	78.8483	81.3213	93.0568	101.6649	115.7434					(45)
Energy content (annual)																	
Distribution loss (46)m = 0.15 x (45)m																	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					(46)
Water storage loss:																	
Total storage loss																	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					(56)
If cylinder contains dedicated solar storage																	
	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																	(59)
Combi loss																	(61)
Total heat required for water heating calculated for each month																	
	99.6525	87.1414	91.1585	77.9827	73.8695	64.7988	63.1879	67.0211	69.1231	79.0983	86.4151	98.3819					(62)
WWHRS																	(63a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
PV diverter																	(63b)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
Solar input																	(63c)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
FGHRS																	(63d)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000					
Output from w/h																	
	99.6525	87.1414	91.1585	77.9827	73.8695	64.7988	63.1879	67.0211	69.1231	79.0983	86.4151	98.3819					(64)
12Total per year (kWh/year)																	
Electric shower(s)																	
	56.9876	50.7764	55.4459	52.9113	53.9042	51.4194	53.1333	53.9042	52.9113	55.4459	54.4033	56.9876					(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =																	648.2302 (64a)
Heat gains from water heating, kWh/month																	
	39.1600	34.4795	36.6511	32.7235	31.9434	29.0545	29.0803	30.2313	30.5086	33.6360	35.2046	38.8424					(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan 139.9813	Feb 139.9813	Mar 139.9813	Apr 139.9813	May 139.9813	Jun 139.9813	Jul 139.9813	Aug 139.9813	Sep 139.9813	Oct 139.9813	Nov 139.9813	Dec 139.9813	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.2063	149.6927	135.2063	139.7132	135.2063	139.7132	135.2063	135.2063	139.7132	135.2063	139.7132	135.2063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.0617	270.8433	263.8337	248.9110	230.0737	212.3694	200.5418	197.7602	204.7698	219.6925	238.5297	256.2341	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	36.9981	(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)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	(71)
Water heating gains (Table 5)	52.6344	51.3087	49.2622	45.4493	42.9347	40.3535	39.0864	40.6335	42.3731	45.2097	48.8953	52.2075	(72)
Total internal gains	520.8969	536.8392	513.2966	499.0679	473.2092	457.4305	439.8289	438.5944	451.8505	465.1030	492.1326	508.6423	(73)

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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				7.3800	10.6334	0.6300		0.7000		0.7700	23.9828 (74)
Southeast				10.8900	36.7938	0.6300		0.7000		0.7700	122.4545 (77)
South				5.5200	46.7521	0.6300		0.7000		0.7700	78.8700 (78)
East				3.1100	26.2379	0.6300		0.7000		1.0000	32.3870 (82)
Solar gains	257.6943	448.5965	639.0822	833.7040	971.6228	981.1204	939.0360	833.6858	706.1316	502.6465	219.3862 (83)
Total gains	778.5912	985.4357	1152.3788	1332.7719	1444.8320	1438.5509	1378.8650	1272.2802	1157.9821	967.7495	728.0285 (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	24.1075	24.1757	24.2429	24.5635	24.6244	24.9121	24.9121	24.9661	24.8005	24.6244	24.5014	24.3742
alpha	2.6072	2.6117	2.6162	2.6376	2.6416	2.6608	2.6608	2.6644	2.6534	2.6416	2.6334	2.6249
util living area	0.9603	0.9297	0.8835	0.7960	0.6740	0.5242	0.4006	0.4444	0.6419	0.8442	0.9370	0.9661 (86)
MIT	18.3480	18.7828	19.3387	20.0048	20.5109	20.8235	20.9368	20.9155	20.6831	19.9874	19.0527	18.2805 (87)
Th 2	19.8520	19.8549	19.8577	19.8708	19.8733	19.8848	19.8848	19.8869	19.8803	19.8733	19.8683	19.8631 (88)
util rest of house	0.9537	0.9185	0.8650	0.7641	0.6234	0.4510	0.3084	0.3498	0.5714	0.8120	0.9251	0.9604 (89)
MIT 2	17.4608	17.8874	18.4275	19.0651	19.5202	19.7837	19.8598	19.8511	19.6817	19.0686	18.1678	17.4017 (90)
Living area fraction									fLA = Living area / (4) =			0.3226 (91)
MIT	17.7470	18.1763	18.7215	19.3682	19.8398	20.1191	20.2072	20.1944	20.0048	19.3650	18.4533	17.6852 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7470	18.1763	18.7215	19.3682	19.8398	20.1191	20.2072	20.1944	20.0048	19.3650	18.4533	17.6852 (93)

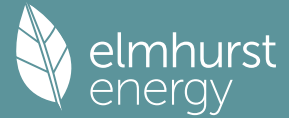
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9373	0.8975	0.8428	0.7480	0.6218	0.4671	0.3360	0.3770	0.5799	0.7948	0.9057	0.9454 (94)
Useful gains	729.7521	884.4775	971.2253	996.9043	898.3703	672.0127	463.2665	479.7009	671.4677	769.1252	726.8602	688.2921 (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	1860.3555	1831.5583	1681.3665	1421.3675	1102.4790	738.8941	482.9324	506.8976	794.0820	1187.1573	1545.4381	1845.2249 (97)
Space heating kWh	841.1690	636.4383	528.3450	305.6135	151.8569	0.0000	0.0000	0.0000	0.0000	311.0159	589.3761	860.7580 (98a)
Space heating requirement - total per year (kWh/year)												4224.5726
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	841.1690	636.4383	528.3450	305.6135	151.8569	0.0000	0.0000	0.0000	0.0000	311.0159	589.3761	860.7580 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4224.5726
Space heating per m2										(98c) / (4) =		39.2618 (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	1258.4649	990.7064	1015.2811	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8053	0.8598	0.8328	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1013.3847	851.7785	845.5525	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1589.1936	1524.0151	1407.7810	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	414.5824	500.1441	418.2980	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	103.6456	125.0360	104.5745	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												333.2561 (107)
Energy for space heating												39.2618 (99)
Energy for space cooling												3.0972 (108)
Total												42.3590 (109)
Fabric Energy Efficiency (TFEE)												42.4 (109)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.8230 (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) =	Air changes per hour 30.0000 / (5) = 0.1025 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3025 (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) = 0.2798 (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	0.3567	0.3497	0.3427	0.3077	0.3007	0.2658	0.2658	0.2588	0.2798	0.3007	0.3147	0.3287 (22b)
Effective ac	0.5636	0.5611	0.5587	0.5474	0.5452	0.5353	0.5353	0.5335	0.5391	0.5452	0.5495	0.5540 (25)

3. Heat losses and heat loss parameter

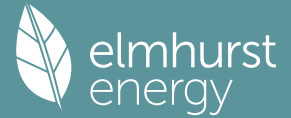
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.5545		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			111.2600			9.0000	1001.3400 (32c)
Internal Floor - 1st Floor			39.8900			18.0000	718.0200 (32d)
Internal Floor - 2nd Floor			25.6400			18.0000	461.5200 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12006.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 111.5869 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	17.0000	0.0580	0.9860
E3 Sill	11.6000	0.0450	0.5220
E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.0550	1.0890
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925

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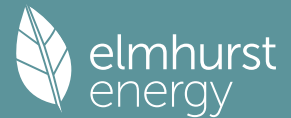
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.0463 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	84.6008 (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	54.4634	54.2246	53.9906	52.8916	52.6860	51.7287	51.7287	51.5515	52.0975	52.6860	53.1020	53.5369 (38)
Average = Sum(39)m / 12 =	139.0641	138.8254	138.5914	137.4924	137.2868	136.3295	136.3295	136.1523	136.6982	137.2868	137.7027	138.1376 (39)
												137.4914
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2924	1.2902	1.2880	1.2778	1.2759	1.2670	1.2670	1.2654	1.2704	1.2759	1.2798	1.2838 (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												2.7996 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												86.3998 (42b)
Hot water usage for other uses												45.5800 (42c)
Average daily hot water use (litres/day)												121.5426 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	131.9798	129.0392	125.5748	120.5856	116.4334	112.0097	110.5155	113.9673	117.5784	122.1958	127.2536	131.6877 (44)
Energy content (annual)	209.0237	183.7501	193.0037	165.0757	156.7418	137.7290	133.6589	141.1153	144.9859	165.8186	181.2961	206.1911 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2018.3898
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
If cylinder contains dedicated solar storage												
Primary loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month												
WWHRS	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h												
Electric shower(s)												
Heat gains from water heating, kWh/month												
	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899 (64)
												Total per year (kWh/year) = Sum(64)m = 2658.8918 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
	113.0194	100.4044	107.6928	97.0029	95.6357	87.9101	87.9606	90.4399	90.3230	98.6537	102.3962	112.0776 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	30.6763	27.2465	22.1583	16.7753	12.5397	10.5865	11.4391	14.8690	19.9572	25.3402	29.5758	31.5289 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	400.0921	404.2438	393.7816	371.5089	343.3936	316.9692	299.3161	295.1644	305.6266	327.8993	356.0145	382.4389 (68)
Pumps, fans	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851 (71)
Total internal gains	151.9078	149.4113	144.7484	134.7262	128.5426	122.0973	118.2266	121.5590	125.4486	132.5991	142.2169	150.6419 (72)
	693.2661	691.4915	671.2782	633.6003	595.0658	560.2430	539.5718	542.1823	561.6223	596.4285	638.3971	675.1997 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.6400	10.6334	0.6300	0.7000	0.7700	31.3271 (74)
Southeast	14.2100	36.7938	0.6300	0.7000	0.7700	159.7868 (77)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739 (78)
East	4.0600	26.2379	0.6300	0.7000	1.0000	42.2802 (82)
Solar gains	336.2680	585.3933	834.0048	1088.0484	1268.0958	1280.5136
Total gains	1029.5342	1276.8847	1505.2830	1721.6487	1863.1617	1840.7566
			1225.5780	1088.0450	921.5254	655.9359
			1765.1498	1630.2273	1483.1477	1252.3644
						405.0775
						286.2775 (83)
						961.4772 (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	23.9832	24.0245	24.0650	24.2574	24.2937	24.4643	24.4643	24.4962	24.3983	24.2937	24.2203	24.1441
alpha	2.5989	2.6016	2.6043	2.6172	2.6196	2.6310	2.6310	2.6331	2.6266	2.6196	2.6147	2.6096
util living area	0.9290	0.8847	0.8173	0.7110	0.5778	0.4365	0.3265	0.3645	0.5485	0.7693	0.8952	0.9387 (86)
Living	19.1472	19.4774	19.8912	20.3223	20.6274	20.7954	20.8534	20.8427	20.7176	20.2903	19.6333	19.0766
Non living	17.7126	18.1213	18.6263	19.1405	19.4804	19.6550	19.7028	19.6975	19.5865	19.1231	18.3301	17.6293
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	20.0522	19.4774	19.8912	20.3223	20.6274	20.7954	20.8534	20.8427	20.7176	20.2903	19.6333	19.3456 (87)
Th 2	19.8468	19.8485	19.8502	19.8583	19.8598	19.8668	19.8668	19.8681	19.8641	19.8598	19.8567	19.8535 (88)
util rest of house	0.9182	0.8684	0.7924	0.6738	0.5261	0.3694	0.2472	0.2817	0.4787	0.7291	0.8773	0.9292 (89)
MIT 2	18.9959	18.1213	18.6263	19.1405	19.4804	19.6550	19.7028	19.6975	19.5865	19.1231	18.3301	18.0301 (90)
Living area fraction	19.3367	18.5588	19.0344	19.5217	19.8504	20.0228	20.0739	20.0669	fLA = Living area / (4) =	19.4997	18.7505	0.3226 (91)
MIT	19.3367	18.5588	19.0344	19.5217	19.8504	20.0228	20.0739	20.0669	19.9514	19.4997	18.7505	18.4545 (92)
Temperature adjustment	19.3367	18.5588	19.0344	19.5217	19.8504	20.0228	20.0739	20.0669	19.9514	19.4997	18.7505	0.0000
adjusted MIT	19.3367	18.5588	19.0344	19.5217	19.8504	20.0228	20.0739	20.0669	19.9514	19.4997	18.7505	18.4545 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9127	0.8462	0.7721	0.6617	0.5256	0.3790	0.2621	0.2967	0.4844	0.7147	0.8561	0.9148 (94)
Useful gains	939.6327	1080.5532	1162.2561	1139.2787	979.3640	697.6473	462.6315	483.6923	718.4005	895.0986	893.2855	879.5393 (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	2091.0624	1896.1831	1737.1551	1460.4059	1118.9448	739.2938	473.6006	499.2618	799.8723	1221.8043	1604.3069	1969.0797 (97)
Space heating kWh	856.6637	548.1033	427.7249	231.2116	103.8481	0.0000	0.0000	0.0000	0.0000	243.0691	511.9354	810.6181 (98a)
Space heating requirement - total per year (kWh/year)												3733.1741
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	856.6637	548.1033	427.7249	231.2116	103.8481	0.0000	0.0000	0.0000	0.0000	243.0691	511.9354	810.6181 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3733.1741
Space heating per m2										(98c) / (4) =		34.6949 (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 %)												364.3775 (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	856.6637	548.1033	427.7249	231.2116	103.8481	0.0000	0.0000	0.0000	0.0000	243.0691	511.9354	810.6181 (98)
Space heating efficiency (main heating system 1)	364.3775	364.3775	364.3775	364.3775	364.3775	0.0000	0.0000	0.0000	0.0000	364.3775	364.3775	364.3775 (210)
Space heating fuel (main heating system)	235.1034	150.4218	117.3851	63.4539	28.5002	0.0000	0.0000	0.0000	0.0000	66.7080	140.4959	222.4666 (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)

elmhurst
energy

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

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	1024.5348	0.1559	159.7344 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1424.4430	0.1409	200.6488 (264)
Space and water heating			360.3832 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	216.7015	0.1443	31.2767 (268)
Total CO2, kg/year			391.6599 (272)
CO2 emissions per m2			3.6400 (273)
EI value			96.5608
EI rating			97 (274)

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EI band

A

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 292.8230 (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) = 0.1025 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3025 (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) = 0.2798 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3007	0.2868	0.2868	0.2658	0.2728	0.2378	0.2378	0.2308	0.2378	0.2658	0.2588	0.2798 (22b)
Effective ac	0.5452	0.5411	0.5411	0.5353	0.5372	0.5283	0.5283	0.5266	0.5283	0.5353	0.5335	0.5391 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.5545		(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			111.2600		9.0000	9.0000	1001.3400 (32c)
Internal Floor - 1st Floor			39.8900		18.0000	18.0000	718.0200 (32d)
Internal Floor - 2nd Floor			25.6400		18.0000	18.0000	461.5200 (32d)
Internal Ceiling - G Floor			29.5600		9.0000	9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600		9.0000	9.0000	159.8400 (32e)

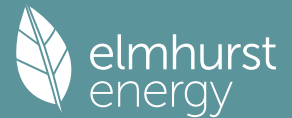
Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12006.7500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 111.5869 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	17.0000	0.0580	0.9860
E3 Sill	11.6000	0.0450	0.5220
E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.0550	1.0890

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E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.0463 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss		(33) + (36) + (36a) =	84.6008 (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	52.6860	52.2889	52.2889	51.7287	51.9107	51.0480	51.0480	50.8897	51.0480	51.7287	51.5515	52.0975 (38)
Average = Sum(39)m / 12 =	137.2868	136.8897	136.8897	136.3295	136.5115	135.6488	135.6488	135.4905	135.6488	136.3295	136.1523	136.6982 (39)
												136.2937
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2759	1.2722	1.2722	1.2670	1.2687	1.2607	1.2607	1.2592	1.2607	1.2670	1.2654	1.2704 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

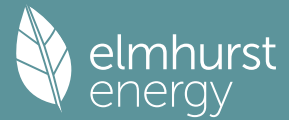
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7996 (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	86.3998	85.1167	83.3097	79.9780	77.4833	74.7170	73.2228	75.0171	76.9708	79.9308	83.3311	86.1077	86.1077 (42b)
Hot water usage for other uses	45.5800	43.9225	42.2651	40.6076	38.9502	37.2927	37.2927	38.9502	40.6076	42.2651	43.9225	45.5800	45.5800 (42c)
Average daily hot water use (litres/day)													121.5426 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	131.9798	129.0392	125.5748	120.5856	116.4334	112.0097	110.5155	113.9673	117.5784	122.1958	127.2536	131.6877	(44)
Energy content (annual)	209.0237	183.7501	193.0037	165.0757	156.7418	137.7290	133.6589	141.1153	144.9859	165.8186	181.2961	206.1911	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2018.3898
	31.3536	27.5625	28.9506	24.7613	23.5113	20.6593	20.0488	21.1673	21.7479	24.8728	27.1944	30.9287	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(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													
	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	(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													
	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	(64)
													Total per year (kWh/year) = Sum(64)m = 2658.8918 (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													
	113.0194	100.4044	107.6928	97.0029	95.6357	87.9101	87.9606	90.4399	90.3230	98.6537	102.3962	112.0776	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	(66)
	30.6763	27.2465	22.1583	16.7753	12.5397	10.5865	11.4391	14.8690	19.9572	25.3402	29.5758	31.5289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.0921	404.2438	393.7816	371.5089	343.3936	316.9692	299.3161	295.1644	305.6266	327.8993	356.0145	382.4389	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	(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)

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Losses e.g. evaporation (negative values) (Table 5)

	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851 (71)
Water heating gains (Table 5)	151.9078	149.4113	144.7484	134.7262	128.5426	122.0973	118.2266	121.5590	125.4486	132.5991	142.2169	150.6419 (72)
Total internal gains	693.2661	691.4915	671.2782	633.6003	595.0658	560.2430	539.5718	542.1823	561.6223	596.4285	638.3971	675.1997 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	9.6400	12.7650	0.6300	0.7000	0.7000	0.7700	37.6072 (74)
Southeast	14.2100	43.0593	0.6300	0.7000	0.7000	0.7700	186.9961 (77)
South	7.2000	54.2217	0.6300	0.7000	0.7000	0.7700	119.3102 (78)
East	4.0600	31.9987	0.6300	0.7000	0.7000	1.0000	51.5631 (82)

Solar gains	395.4766	602.3415	855.1619	1139.7295	1300.6461	1392.0818	1318.1021	1195.0951	1009.6286	725.2074	469.4205	338.5783 (83)
Total gains	1088.7428	1293.8329	1526.4401	1773.3298	1895.7119	1952.3248	1857.6739	1737.2774	1571.2509	1321.6359	1107.8177	1013.7780 (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	24.2937	24.3642	24.3642	24.4643	24.4317	24.5871	24.5871	24.6158	24.5871	24.4643	24.4962	24.3983
alpha	2.6196	2.6243	2.6243	2.6310	2.6288	2.6391	2.6391	2.6411	2.6391	2.6310	2.6331	2.6266
util living area	0.9119	0.8692	0.7915	0.6650	0.5147	0.3452	0.2367	0.2593	0.4696	0.7172	0.8668	0.9232 (86)
Living	19.3638	19.6437	20.0481	20.4560	20.7171	20.8436	20.8737	20.8709	20.7864	20.4391	19.8465	19.3007
Non living	17.9926	18.3377	18.8252	19.2996	19.5778	19.6994	19.7197	19.7198	19.6559	19.2969	18.5999	17.9183
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	20.1630	19.6437	20.0481	20.4560	20.7171	20.8436	20.8737	20.8709	20.7864	20.4391	19.8465	19.5384 (87)
Th 2	19.8598	19.8627	19.8627	19.8668	19.8654	19.8718	19.8718	19.8729	19.8718	19.8668	19.8681	19.8641 (88)
util rest of house	0.8984	0.8504	0.7630	0.6228	0.4572	0.2756	0.1575	0.1758	0.3947	0.6694	0.8441	0.9111 (89)
MIT 2	19.1154	18.3377	18.8252	19.2996	19.5778	19.6994	19.7197	19.7198	19.6559	19.2969	18.5999	18.2689 (90)
Living area fraction	19.4533	18.7590	19.2197	19.6726	19.9453	20.0685	20.0920	20.0912	20.0206	19.6654	19.0020	0.3226 (91)
MIT	19.4533	18.7590	19.2197	19.6726	19.9453	20.0685	20.0920	20.0912	20.0206	19.6654	19.0020	18.6784 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4533	18.7590	19.2197	19.6726	19.9453	20.0685	20.0920	20.0912	20.0206	19.6654	19.0020	18.6784 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8929	0.8287	0.7448	0.6150	0.4614	0.2880	0.1732	0.1922	0.4050	0.6599	0.8233	0.8957 (94)
Useful gains	972.1455	1072.1393	1136.9292	1090.5522	874.7539	562.3434	321.7894	333.9287	636.4278	872.1862	912.0206	908.0289 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	1970.5190	1787.6442	1617.9946	1332.2961	961.7709	579.0179	324.4726	337.5290	681.0404	1113.1813	1497.9516	1856.1478 (97)
Space heating kWh	742.7899	480.8193	357.9127	174.0557	64.7406	0.0000	0.0000	0.0000	0.0000	179.3004	421.8703	705.4005 (98a)
Space heating requirement - total per year (kWh/year)												3126.8892
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	742.7899	480.8193	357.9127	174.0557	64.7406	0.0000	0.0000	0.0000	0.0000	179.3004	421.8703	705.4005 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3126.8892
Space heating per m2										(98c) / (4) =		29.0603 (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 %)												363.8169 (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	742.7899	480.8193	357.9127	174.0557	64.7406	0.0000	0.0000	0.0000	0.0000	179.3004	421.8703	705.4005 (98)
Space heating efficiency (main heating system 1)	363.8169	363.8169	363.8169	363.8169	363.8169	0.0000	0.0000	0.0000	0.0000	363.8169	363.8169	363.8169 (210)
Space heating fuel (main heating system)	204.1659	132.1597	98.3771	47.8416	17.7948	0.0000	0.0000	0.0000	0.0000	49.2831	115.9568	193.8889 (211)

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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	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	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	0.0000	(215)
Water heating														
Water heating requirement	263.4225	232.8845	247.4025	217.7197	211.1406	190.3730	188.0577	195.5141	197.6299	220.2174	233.9401	260.5899	186.7264	(64)
Efficiency of water heater	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	(216)
Fuel for water heating, kWh/month	141.0741	124.7196	132.4947	116.5982	113.0748	101.9529	100.7130	104.7062	105.8393	117.9359	125.2850	139.5571	186.7264	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
(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	0.0000	(231)
Pumps and Fa	26.8508	21.5407	19.3950	14.2096	10.9759	8.9674	10.0126	13.0148	16.9049	22.1801	25.0524	27.5971	0.0000	(232)
Lighting	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	(233a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
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	0.0000	(234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
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	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
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	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
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	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
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	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
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	0.0000	(235d)
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Annual totals kWh/year														
Space heating fuel - main system 1													859.4678	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													186.7264	
Water heating fuel used													1423.9507	(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)													216.7015	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													0.0000	(233)
Wind generation													0.0000	(234)
Hydro-electric generation (Appendix N)													0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)													0.0000	(235)
Appendix Q - special features														
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													2500.1201	(238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	859.4678	18.3900	158.0561 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1423.9507	18.3900	261.8645 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	216.7015	18.3900	39.8514 (250)
Additional standing charges			0.0000 (251)
Total energy cost			459.7721 (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	859.4678	0.1565	134.4824 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1423.9507	0.1409	200.5794 (264)
Space and water heating			335.0618 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	216.7015	0.1443	31.2767 (268)
Total CO2, kg/year			366.3386 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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Space heating - main system 1	859.4678	1.5792	1357.2981 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1423.9507	1.5209	2165.6178 (278)
Space and water heating			3522.9159 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	216.7015	1.5338	332.3840 (282)
Total Primary energy kWh/year			3855.2999 (286)

SAP 10 EPC IMPROVEMENTS

P22691(6)

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 60	-41 kg (11.1%)
U Solar photovoltaic panels	+ 5.5	-£ 169	-124 kg (38.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£60	0.38 kg/m²	B 85 A 97
Solar photovoltaic panels	£169	1.15 kg/m²	B 91 A 98
Total Savings	£230	1.53 kg/m²	

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 511 TEST (31 Jan 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £460	Potential £399	Saving £60
Electricity			
Space heating	£158	£173	-£15
Water heating	£262	£187	£75
Lighting	£40	£40	£0
Generated (PV)	-£0	-£169	£169
Total cost of fuels	£460	£230	£229
Total cost of uses	£460	£231	£229
Delivered energy	23 kWh/m²	12 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.2 tonnes	0.2 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	2 kg/m²
Primary energy	36 kWh/m²	19 kWh/m²	17 kWh/m²

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

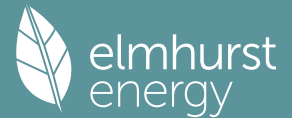
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	38.0700 (1b)	x 2.5000 (2b)	= 95.1750 (1b) -
First floor	39.8900 (1c)	x 2.8000 (2c)	= 111.6920 (1c) -
Second floor	29.6400 (1d)	x 2.9000 (2d)	= 85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.8230 (5)

2. Ventilation rate

Number of open chimneys 0 * 80 = 0.0000 (6a) m³ per hour

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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	Air changes per hour	30.0000 / (5) =	0.1025 (8)
Pressure test			Yes		
Pressure Test Method			Blower Door		
Measured/design AP50			4.0000		(17)
Infiltration rate			0.3025		(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) =				0.2798 (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
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
Effective ac	0.3567	0.3497	0.3427	0.3077	0.3007	0.2658	0.2658	0.2588	0.2798	0.3007	0.3147	0.3287
	0.5636	0.5611	0.5587	0.5474	0.5452	0.5353	0.5353	0.5335	0.5391	0.5452	0.5495	0.5540

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)
Total net area of external elements Aum(A, m2)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.5545	(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			111.2600			9.0000	1001.3400 (32c)
Internal Floor - 1st Floor			39.8900			18.0000	718.0200 (32d)
Internal Floor - 2nd Floor			25.6400			18.0000	461.5200 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12006.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		111.5869 (35)

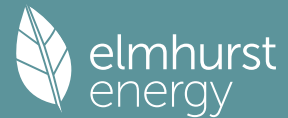
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	17.0000	0.0580	0.9860
E3 Sill	11.6000	0.0450	0.5220
E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.0550	1.0890
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728
E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624
E15 Flat roof with parapet	7.0000	0.3000	2.1000
E16 Corner (normal)	12.1000	0.0440	0.5324
E18 Party wall between dwellings	2.5000	0.0370	0.0925
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402
P1 Party wall - Ground floor	7.6000	0.0490	0.3724
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040
R1 Head of roof window	3.1000	0.2400	0.7440
R2 Sill of roof window	3.1000	0.2400	0.7440
R3 Jamb of roof window	4.8000	0.2400	1.1520
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.0463 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 84.6008 (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	54.4634	54.2246	53.9906	52.8916	52.6860	51.7287	51.7287	51.5515	52.0975	52.6860	53.1020	53.5369
Average = Sum(39)m / 12 =	139.0641	138.8254	138.5914	137.4924	137.2868	136.3295	136.3295	136.1523	136.6982	137.2868	137.7027	138.1376
												137.4914
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2924	1.2902	1.2880	1.2778	1.2759	1.2670	1.2670	1.2654	1.2704	1.2759	1.2798	1.2838
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7996 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	86.3998	85.1167	83.3097	79.9780	77.4833	74.7170	73.2228	75.0171	76.9708	79.9308	83.3311	86.1077 (42b)
Hot water usage for other uses	45.5800	43.9225	42.2651	40.6076	38.9502	37.2927	37.2927	38.9502	40.6076	42.2651	43.9225	45.5800 (42c)
Average daily hot water use (litres/day)												121.5426 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	131.9798	129.0392	125.5748	120.5856	116.4334	112.0097	110.5155	113.9673	117.5784	122.1958	127.2536	131.6877 (44)
Distribution loss (46)m = 0.15 x (45)m	209.0237	183.7501	193.0037	165.0757	156.7418	137.7290	133.6589	141.1153	144.9859	165.8186	181.2961	206.1911 (45)
Total = Sum(45)m =												2018.3898
Water storage loss:												150.0000 (47)
Store volume												1.8600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.0044 (55)
Enter (49) or (54) in (55)												
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	263.4225	232.8845	246.0068	210.9661	198.3462	177.7663	175.0308	183.4176	192.2270	218.8217	233.9401	260.5899 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												618.6452 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												618.6452
Solar input	-0.0000	-16.2153	-58.1426	-79.7776	-103.9558	-95.8218	-95.1668	-83.3159	-57.5986	-28.6510	-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	263.4225	216.6692	187.8642	131.1885	94.3905	81.9445	79.8640	100.1018	134.6285	190.1707	233.9401	260.5899 (64)
Total per year (kWh/year) = Sum(64)m =												1974.7742 (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	113.0194	100.4044	106.5762	91.6000	85.4002	77.8247	77.5391	80.7627	86.0007	97.5371	102.3962	112.0776 (65)

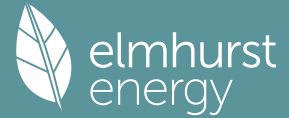
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.6763	27.2465	22.1583	16.7753	12.5397	10.5865	11.4391	14.8690	19.9572	25.3402	29.5758	31.5289 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.0921	404.2438	393.7816	371.5089	343.3936	316.9692	299.3161	295.1644	305.6266	327.8993	356.0145	382.4389 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974 (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)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851 (71)
Water heating gains (Table 5)	151.9078	149.4113	143.2476	127.2222	114.7852	108.0899	104.2192	108.5520	119.4454	131.0983	142.2169	150.6419 (72)
Total internal gains	693.2661	691.4915	669.7774	626.0963	581.3085	546.2356	525.5643	529.1754	555.6191	594.9277	638.3971	675.1997 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	9.6400	10.6334	0.6300	0.7000	0.7700	31.3271 (74)
Southeast	14.2100	36.7938	0.6300	0.7000	0.7700	159.7868 (77)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739 (78)

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East	4.0600		26.2379		0.6300		0.7000		1.0000		42.2802 (82)	
Solar gains	336.2680	585.3933	834.0048	1088.0484	1268.0958	1280.5136	1225.5780	1088.0450	921.5254	655.9359	405.0775	286.2775 (83)
Total gains	1029.5342	1276.8847	1503.7822	1714.1447	1849.4043	1826.7492	1751.1423	1617.2204	1477.1445	1250.8636	1043.4746	961.4772 (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	23.9832	24.0245	24.0650	24.2574	24.2937	24.4643	24.4643	24.4962	24.3983	24.2937	24.2203	24.1441
alpha	2.5989	2.6016	2.6043	2.6172	2.6196	2.6310	2.6310	2.6331	2.6266	2.6196	2.6147	2.6096
util living area	0.9290	0.8847	0.8176	0.7126	0.5807	0.4393	0.3288	0.3671	0.5501	0.7697	0.8952	0.9387 (86)
Living	19.1472	19.4774	19.8902	20.3190	20.6242	20.7940	20.8529	20.8420	20.7164	20.2895	19.6333	19.0766
Non living	17.7126	18.1213	18.6252	19.1369	19.4774	19.6540	19.7025	19.6971	19.5855	19.1222	18.3301	17.6293
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	20.0522	19.4774	19.8902	20.3190	20.6242	20.7940	20.8529	20.8420	20.7164	20.2895	19.6333	19.3456 (87)
Th 2	19.8468	19.8485	19.8502	19.8583	19.8598	19.8668	19.8668	19.8681	19.8641	19.8598	19.8567	19.8535 (88)
util rest of house	0.9182	0.8684	0.7927	0.6754	0.5290	0.3719	0.2491	0.2838	0.4802	0.7295	0.8773	0.9292 (89)
MIT 2	18.9959	18.1213	18.6252	19.1369	19.4774	19.6540	19.7025	19.6971	19.5855	19.1222	18.3301	18.0301 (90)
Living area fraction									fLA = Living area / (4) =			0.3226 (91)
MIT	19.3367	18.5588	19.0332	19.5182	19.8473	20.0217	20.0736	20.0664	19.9503	19.4988	18.7505	18.4545 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3367	18.5588	19.0332	19.5182	19.8473	20.0217	20.0736	20.0664	19.9503	19.4988	18.7505	18.4545 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9127	0.8462	0.7724	0.6633	0.5284	0.3815	0.2640	0.2989	0.4859	0.7151	0.8561	0.9148 (94)
Useful gains	939.6327	1080.5532	1161.5467	1136.9908	977.2219	696.8494	462.3844	483.3503	717.6735	894.5299	893.2855	879.5393 (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	2091.0624	1896.1831	1736.9997	1459.9261	1118.5183	739.1406	473.5519	499.1949	799.7286	1221.6825	1604.3069	1969.0797 (97)
Space heating kWh	856.6637	548.1033	428.1371	232.5134	105.1245	0.0000	0.0000	0.0000	0.0000	243.4016	511.9354	810.6181 (98a)
Space heating requirement - total per year (kWh/year)												3736.4970
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	856.6637	548.1033	428.1371	232.5134	105.1245	0.0000	0.0000	0.0000	0.0000	243.4016	511.9354	810.6181 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3736.4970
Space heating per m2										(98c) / (4) =		34.7258 (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 %)												364.3775 (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	856.6637	548.1033	428.1371	232.5134	105.1245	0.0000	0.0000	0.0000	0.0000	243.4016	511.9354	810.6181 (98)
Space heating efficiency (main heating system 1)	364.3775	364.3775	364.3775	364.3775	364.3775	0.0000	0.0000	0.0000	0.0000	364.3775	364.3775	364.3775 (210)
Space heating fuel (main heating system)	235.1034	150.4218	117.4982	63.8111	28.8504	0.0000	0.0000	0.0000	0.0000	66.7993	140.4959	222.4666 (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	263.4225	216.6692	187.8642	131.1885	94.3905	81.9445	79.8640	100.1018	134.6285	190.1707	233.9401	260.5899 (64)
Efficiency of water heater	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619	186.6619 (216)
Fuel for water heating, kWh/month	141.1228	116.0758	100.6441	70.2813	50.5676	43.8999	42.7854	53.6273	72.1243	101.8798	125.3283	139.6053 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	26.8508	21.5407	19.3950	14.2096	10.9759	8.9674	10.0126	13.0148	16.9049	22.1801	25.0524	27.5971 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-38.5423	-57.1060	-85.2943	-97.6141	-104.3676	-94.9698	-93.6087	-88.1011	-77.8685	-65.6422	-43.0103	-32.8457 (233a)

10a. Fuel costs - using Table 12 prices

11a. SAP rating - Individual heating systems

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

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
Ground floor	38.0700 (1b)	x	2.5000 (2b)	=	95.1750 (1b) -
First floor	39.8900 (1c)	x	2.8000 (2c)	=	111.6920 (1c) -
Second floor	29.6400 (1d)	x	2.9000 (2d)	=	85.9560 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.6000				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	292.8230 (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) =	0.1025 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000 (17)	
Infiltration rate		0.3025 (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) =	0.2798 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3007	0.2868	0.2868	0.2658	0.2728	0.2378	0.2378	0.2308	0.2378	0.2658	0.2588	0.2798 (22b)
Effective ac	0.5452	0.5411	0.5411	0.5353	0.5372	0.5283	0.5283	0.5266	0.5283	0.5353	0.5335	0.5391 (25)

3. Heat losses and heat loss parameter

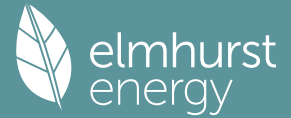
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows/Doors (Uw = 1.20)			31.0500	1.1450	35.5534		(27)
Rooflights			4.0600	1.5918	6.4625		(27a)
Ground Floor			38.0700	0.1000	3.8070	110.0000	4187.7000 (28a)
External Wall	145.6000	31.0500	114.5500	0.1500	17.1825	9.0000	1030.9500 (29a)
External Roof - Sloping	33.4700	4.0600	29.4100	0.1500	4.4115	9.0000	264.6900 (30)
External Roof - Flat Roof	14.2500		14.2500	0.1500	2.1375	9.0000	128.2500 (30)
Total net area of external elements Aum(A, m ²)			231.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	69.5545			(33)
Party Wall 1			54.1200	0.0000	0.0000	70.0000	3788.4000 (32)
Internal Walls - Timber			111.2600			9.0000	1001.3400 (32c)
Internal Floor - 1st Floor			39.8900			18.0000	718.0200 (32d)
Internal Floor - 2nd Floor			25.6400			18.0000	461.5200 (32d)
Internal Ceiling - G Floor			29.5600			9.0000	266.0400 (32e)
Internal Ceiling - 1st Floor			17.7600			9.0000	159.8400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12006.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		111.5869 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	17.0000	0.0580	0.9860
E3 Sill	11.6000	0.0450	0.5220
E4 Jamb	46.6000	0.0500	2.3300
E5 Ground floor (normal)	19.8000	0.0550	1.0890
E6 Intermediate floor within a dwelling	36.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	4.8000	0.0360	0.1728

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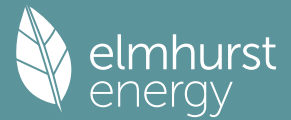


E13 Gable (insulation at rafter level)	9.6000	0.0690	0.6624											
E15 Flat roof with parapet	7.0000	0.3000	2.1000											
E16 Corner (normal)	12.1000	0.0440	0.5324											
E18 Party wall between dwellings	2.5000	0.0370	0.0925											
E25 Staggered party wall between dwellings	14.6000	0.0370	0.5402											
P1 Party wall - Ground floor	7.6000	0.0490	0.3724											
P2 Party wall - Intermediate floor within a dwelling	13.2000	0.0000	0.0000											
P4 Party wall - Roof (insulation at ceiling level)	3.3000	0.0770	0.2541											
P5 Party wall - Roof (insulation at rafter level)	4.8000	0.4800	2.3040											
R1 Head of roof window	3.1000	0.2400	0.7440											
R2 Sill of roof window	3.1000	0.2400	0.7440											
R3 Jamb of roof window	4.8000	0.2400	1.1520											
R4 Ridge (vaulted ceiling)	4.8000	0.1200	0.5760											
E17 Corner (inverted - internal area greater than external area)	2.5000	-0.0510	-0.1275											
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				15.0463 (36)										
Point Thermal bridges			(36a) =	0.0000										
Total fabric heat loss		(33) + (36) + (36a) =		84.6008 (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	52.6860	52.2889	52.2889	51.7287	51.9107	51.0480	51.0480	50.8897	51.0480	51.7287	51.5515	52.0975	(38)	
Average = Sum(39)m / 12 =	137.2868	136.8897	136.8897	136.3295	136.5115	135.6488	135.6488	135.4905	135.6488	136.3295	136.1523	136.6982	(39)	
												136.2937		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
HLP (average)	1.2759	1.2722	1.2722	1.2670	1.2687	1.2607	1.2607	1.2592	1.2607	1.2670	1.2654	1.2704	(40)	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31		
													1.2667	
													31	

4. Water heating energy requirements (kWh/year)														

Assumed occupancy													2.7996 (42)	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)	
Hot water usage for baths	86.3998	85.1167	83.3097	79.9780	77.4833	74.7170	73.2228	75.0171	76.9708	79.9308	83.3311	86.1077	(42b)	
Hot water usage for other uses	45.5800	43.9225	42.2651	40.6076	38.9502	37.2927	37.2927	38.9502	40.6076	42.2651	43.9225	45.5800	(42c)	
Average daily hot water use (litres/day)													121.5426 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	131.9798	129.0392	125.5748	120.5856	116.4334	112.0097	110.5155	113.9673	117.5784	122.1958	127.2536	131.6877	(44)	
Energy content	209.0237	183.7501	193.0037	165.0757	156.7418	137.7290	133.6589	141.1153	144.9859	165.8186	181.2961	206.1911	(45)	
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m =	2018.3898
	31.3536	27.5625	28.9506	24.7613	23.5113	20.6593	20.0488	21.1673	21.7479	24.8728	27.1944	30.9287	(46)	
Water storage loss:														
Store volume													150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													1.0044 (55)	
Total storage loss														
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)	
If cylinder contains dedicated solar storage														
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month														
	263.4225	232.8845	246.0068	210.9661	198.3462	177.7663	175.0308	183.4176	192.2270	218.8217	233.9401	260.5899	(62)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)	
Aperture area of solar collector													3.0000 (H1)	
Zero-loss collector efficiency													0.8000 (H2)	
Collector linear heat loss coefficient													1.8000 (H3)	
Collector 2nd order heat loss coefficient													0.0000 (H4)	
Collector loop efficiency													0.9000 (H5)	
Incidence angle modifier													1.0000 (H6)	
Overshading factor													0.8000 (H8)	
Overall heat loss coefficient of system													6.5000 (H10)	
Heat loss coefficient of collector loop													3.9667 (H11)	
Dedicated solar storage volume													75.0000 (H12)	
Effective solar volume													75.0000 (H14)	
Reference volume													225.0000 (H15)	
Storage tank correction coefficient													1.3161 (H16)	
Heat delivered to hot water													697.5664 (H24)	
Heat delivered to space heating													0.0000 (H29)	
Solar input													697.5664	
Solar input	-0.9767	-19.5924	-62.8391	-86.7701	-108.7721	-106.5086	-104.5984	-95.3121	-68.1539	-38.4673	-5.5757	-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														
	262.4458	213.2921	183.1677	124.1960	89.5741	71.2577	70.4324	88.1055	124.0732	180.3544	228.3644	260.5899	(64)	
													Total per year (kWh/year) = Sum(64)m =	1895.8530 (64)
Electric shower(s)														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
													Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)
Heat gains from water heating, kWh/month														
	113.0194	100.4044	106.5762	91.6000	85.4002	77.8247	77.5391	80.7627	86.0007	97.5371	102.3962	112.0776	(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	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	167.9776	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.6763	27.2465	22.1583	16.7753	12.5397	10.5865	11.4391	14.8690	19.9572	25.3402	29.5758	31.5289	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	400.0921	404.2438	393.7816	371.5089	343.3936	316.9692	299.3161	295.1644	305.6266	327.8993	356.0145	382.4389	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	54.5974	(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)	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	-111.9851	(71)
Water heating gains (Table 5)	151.9078	149.4113	143.2476	127.2222	114.7852	108.0899	104.2192	108.5520	119.4454	131.0983	142.2169	150.6419	(72)
Total internal gains	693.2661	691.4915	669.7774	626.0963	581.3085	546.2356	525.5643	529.1754	555.6191	594.9277	638.3971	675.1997	(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	9.6400	12.7650	0.6300	0.7000	0.7700	37.6072 (74)
Southeast	14.2100	43.0593	0.6300	0.7000	0.7700	186.9961 (77)
South	7.2000	54.2217	0.6300	0.7000	0.7700	119.3102 (78)
East	4.0600	31.9987	0.6300	0.7000	1.0000	51.5631 (82)

Solar gains	395.4766	602.3415	855.1619	1139.7295	1300.6461	1392.0818	1318.1021	1195.0951	1009.6286	725.2074	469.4205	338.5783	(83)
Total gains	1088.7428	1293.8329	1524.9393	1765.8258	1881.9546	1938.3173	1843.6665	1724.2704	1565.2477	1320.1351	1107.8177	1013.7780	(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)

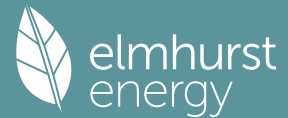
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.2937	24.3642	24.3642	24.4643	24.4317	24.5871	24.5871	24.6158	24.5871	24.4643	24.4962	24.3983	
alpha	2.6196	2.6243	2.6243	2.6310	2.6288	2.6391	2.6391	2.6411	2.6391	2.6310	2.6331	2.6266	
util living area	0.9119	0.8692	0.7919	0.6666	0.5175	0.3474	0.2384	0.2611	0.4710	0.7176	0.8668	0.9232	(86)
Living	19.3638	19.6437	20.0472	20.4533	20.7149	20.8430	20.8736	20.8707	20.7857	20.4384	19.8465	19.3007	
Non living	17.9926	18.3377	18.8242	19.2968	19.5759	19.6990	19.7197	19.7198	19.6554	19.2962	18.5999	17.9183	
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	20.1630	19.6437	20.0472	20.4533	20.7149	20.8430	20.8736	20.8707	20.7857	20.4384	19.8465	19.5384	(87)
Th 2	19.8598	19.8627	19.8627	19.8668	19.8654	19.8718	19.8718	19.8729	19.8718	19.8668	19.8681	19.8641	(88)
util rest of house	0.8984	0.8504	0.7634	0.6245	0.4599	0.2775	0.1587	0.1770	0.3960	0.6698	0.8441	0.9111	(89)
MIT 2	19.1154	18.3377	18.8242	19.2968	19.5759	19.6990	19.7197	19.7198	19.6554	19.2962	18.5999	18.2689	(90)
Living area fraction									fLA = Living area / (4) =			0.3226	(91)
MIT	19.4533	18.7590	19.2187	19.6698	19.9433	20.0680	20.0919	20.0910	20.0200	19.6647	19.0020	18.6784	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4533	18.7590	19.2187	19.6698	19.9433	20.0680	20.0919	20.0910	20.0200	19.6647	19.0020	18.6784	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8929	0.8287	0.7451	0.6165	0.4640	0.2899	0.1745	0.1936	0.4063	0.6603	0.8233	0.8957	(94)
Useful gains	972.1455	1072.1393	1136.2907	1088.7098	873.3145	562.0123	321.7264	333.8462	636.0110	871.7349	912.0206	908.0289	(95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	1970.5190	1787.6442	1617.8570	1331.9189	961.4908	578.9544	324.4591	337.5117	680.9597	1113.0870	1497.9516	1856.1478	(97)
Space heating kWh	742.7899	480.8193	358.2854	175.1106	65.6031	0.0000	0.0000	0.0000	0.0000	179.5659	421.8703	705.4005	(98a)
Space heating requirement - total per year (kWh/year)												3129.4449	
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	742.7899	480.8193	358.2854	175.1106	65.6031	0.0000	0.0000	0.0000	0.0000	179.5659	421.8703	705.4005	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3129.4449	
Space heating per m2										(98c) / (4) =		29.0841	(99)

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

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												363.8169 (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	742.7899	480.8193	358.2854	175.1106	65.6031	0.0000	0.0000	0.0000	0.0000	179.5659	421.8703	705.4005 (98)
Space heating efficiency (main heating system 1)	363.8169	363.8169	363.8169	363.8169	363.8169	0.0000	0.0000	0.0000	0.0000	363.8169	363.8169	363.8169 (210)
Space heating fuel (main heating system)	204.1659	132.1597	98.4796	48.1315	18.0319	0.0000	0.0000	0.0000	0.0000	49.3561	115.9568	193.8889 (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	262.4458	213.2921	183.1677	124.1960	89.5741	71.2577	70.4324	88.1055	124.0732	180.3544	228.3644	260.5899 (64)
Efficiency of water heater	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264	186.7264 (216)
Fuel for water heating, kWh/month	140.5510	114.2271	98.0942	66.5123	47.9708	38.1615	37.7196	47.1843	66.4465	96.5875	122.2989	139.5571 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	26.8508	21.5407	19.3950	14.2096	10.9759	8.9674	10.0126	13.0148	16.9049	22.1801	25.0524	27.5971 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-44.5935	-58.7126	-86.7359	-99.4823	-104.4625	-98.4957	-96.6605	-92.3810	-82.5189	-70.5156	-48.7650	-38.2794 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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												860.1703 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												186.7264
Water heating fuel used												1015.3107 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												216.7015 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-921.6028 (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												1250.5797 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	860.1703	18.3900	158.1853 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1015.3107	18.3900	186.7156 (247)
Energy for instantaneous electric shower(s)	0.0000	18.3900	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	80.0000	18.3900	14.7120 (249)
Energy for lighting	216.7015	18.3900	39.8514 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-921.6028	18.3900	-169.4828
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-169.4828 (252)
Total energy cost			229.9816 (255)

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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	860.1703	0.1565	134.5808 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1015.3107	0.1463	148.5462 (264)
Space and water heating			283.1269 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	216.7015	0.1443	31.2767 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-921.6028	0.1347	-124.1043
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-124.1043 (269)
Total CO2, kg/year			201.3963 (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	860.1703	1.5792	1358.3647 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1015.3107	1.5412	1564.8211 (278)
Space and water heating			2923.1858 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	216.7015	1.5338	332.3840 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-921.6028	1.4977	-1380.2728
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1380.2728 (283)
Total Primary energy kWh/year			1996.3210 (286)