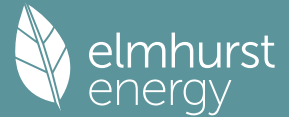


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Property Reference	CPG-7172-23 P4		Issued on Date	13/01/2024	
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	Prop Type Ref	DS		
Property	Plot 4, Collygree Parc, South Road, Penzance, Cornwall, TR20 9LY				
SAP Rating	98 A	DER	-0.51	TER	11.71
Environmental	100 A	% DER < TER			104.36
CO ₂ Emissions (t/year)	-0.11	DFEE	31.52	TFEE	36.05
Compliance Check	See BREL	% DFEE < TFEE			12.58
% DPER < TPER	88.13	DPER	7.27	TPER	61.20
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client	Cornwall Planning Group, CPG				

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	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

2. Ventilation rate

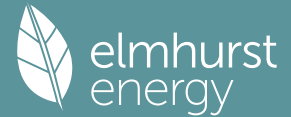
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (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) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	1.0000 (17)
Infiltration rate	0.0500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0425 (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	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m ²)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.6006		(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8169.8400 (34)

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

102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

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

Point Thermal bridges	(36a) =	10.4810 (36)
Total fabric heat loss	(33) + (36) + (36a) =	46.0817 (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	9.8267	9.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467 (38)
Average = Sum(39)m / 12 =	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284 (39)
HLP	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	0.6954 (40)
HLP (average)												0.6925
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.4629 (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	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522 (42c)
Average daily hot water use (litres/day)												106.2689 (43)
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Energy content (annual)												Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage												
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 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (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	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (64)
Total per year (kWh/year)												2354.0047 (64)
Electric shower(s)												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	100.8037	89.5817	96.1465	86.7358	85.6045	78.7857	78.8940	81.0616	80.8954	88.2433	91.4513	99.9802 (65)

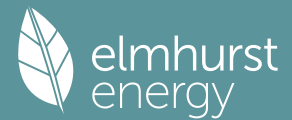
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	135.4889	133.3061	129.2291	120.4664	115.0598	109.4245	106.0403	108.9538	112.3547	118.6066	127.0158	134.3821 (72)
Total internal gains	531.9359	544.5728	522.2150	505.1384	480.4092	464.1829	447.2142	447.8506	460.8919	475.4577	503.1895	521.1468 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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Northeast			4.4100		11.2829		0.7600		0.7000		0.7700		18.3445 (75)
Southwest			7.5600		36.7938		0.7600		0.7000		0.7700		102.5514 (79)

Solar gains	120.8959	212.0238	306.2851	406.6304	480.2215	487.6405	465.6048	409.0375	340.7732	238.6953	145.9151	102.7437	(83)
Total gains	652.8318	756.5965	828.5001	911.7688	960.6306	951.8234	912.8190	856.8881	801.6650	714.1530	649.1046	623.8905	(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	40.5914	40.6423	40.6933	40.9503	41.0020	41.2629	41.2629	41.3155	41.1582	41.0020	40.8986	40.7957	
alpha	3.7061	3.7095	3.7129	3.7300	3.7335	3.7509	3.7509	3.7544	3.7439	3.7335	3.7266	3.7197	
util living area	0.9019	0.8498	0.7782	0.6547	0.5103	0.3642	0.2638	0.2927	0.4588	0.6968	0.8506	0.9132	(86)
Living	20.1470	20.3451	20.5507	20.7526	20.8625	20.9058	20.9150	20.9138	20.8893	20.7427	20.4269	20.1015	
Non living	19.3339	19.5773	19.8268	20.0665	20.1889	20.2366	20.2447	20.2446	20.2203	20.0610	19.6852	19.2803	
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	20.5636	20.3451	20.5507	20.7526	20.8625	20.9058	20.9150	20.9138	20.8893	20.7427	20.4269	20.2272	(87)
Th 2	20.3418	20.3426	20.3434	20.3473	20.3480	20.3519	20.3519	20.3527	20.3504	20.3480	20.3465	20.3449	(88)
util rest of house	0.8919	0.8359	0.7592	0.6291	0.4790	0.3288	0.2254	0.2523	0.4193	0.6672	0.8345	0.9041	(89)
MIT 2	19.9400	19.5773	19.8268	20.0665	20.1889	20.2366	20.2447	20.2446	20.2203	20.0610	19.6852	19.4722	(90)
Living area fraction									FLA = Living area / (4) =			0.4205	(91)
MIT	20.2023	19.9002	20.1312	20.3550	20.4721	20.5180	20.5265	20.5260	20.5016	20.3477	19.9971	19.7897	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2023	19.9002	20.1312	20.3550	20.4721	20.5180	20.5265	20.5260	20.5016	20.3477	19.9971	19.7897	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8896	0.8258	0.7527	0.6294	0.4851	0.3379	0.2358	0.2632	0.4286	0.6672	0.8251	0.8955	(94)
Useful gains	580.7659	624.7640	623.5994	573.8544	465.9542	321.6301	215.2140	225.5004	343.6221	476.4977	535.5694	558.6859	(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	889.0684	837.5839	760.1901	634.8205	485.5235	325.4797	215.9544	226.6333	352.9740	539.5181	715.6411	867.2278	(97)
Space heating kWh	229.3771	143.0149	101.6235	43.8955	14.5596	0.0000	0.0000	0.0000	0.0000	46.8871	129.6516	229.5551	(98a)
Space heating requirement - total per year (kWh/year)												938.5645	
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	229.3771	143.0149	101.6235	43.8955	14.5596	0.0000	0.0000	0.0000	0.0000	46.8871	129.6516	229.5551	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												938.5645	
Space heating per m2										(98c) / (4) =		11.7321	(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 %)													400.0453 (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	229.3771	143.0149	101.6235	43.8955	14.5596	0.0000	0.0000	0.0000	0.0000	46.8871	129.6516	229.5551	(98)
Space heating efficiency (main heating system 1)	400.0453	400.0453	400.0453	400.0453	400.0453	0.0000	0.0000	0.0000	0.0000	400.0453	400.0453	400.0453	(210)
Space heating fuel (main heating system)	57.3378	35.7497	25.4030	10.9726	3.6395	0.0000	0.0000	0.0000	0.0000	11.7205	32.4092	57.3823	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265	(64)
Efficiency of water heater (217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(216)
Fuel for water heating, kWh/month	113.7512	100.5875	106.9072	94.1871	91.4156	82.5043	81.5543	84.7398	85.6045	95.2934	101.1167	112.5410	(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	11.8300	10.6852	11.8300	11.4484	11.8300	11.4484	11.8300	11.8300	11.4484	11.8300	11.4484	11.8300	(231)
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.5795	-61.3361	-92.2252	-106.6243	-116.9756	-109.5834	-108.1057	-101.1305	-87.8308	-71.0905	-46.3324	-35.5139	(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	-17.9305	-40.6820	-87.5556	-141.1582	-193.6645	-197.3280	-194.1408	-160.1991	-112.2678	-61.0804	-24.8180	-13.8905	(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													234.6146 (211)

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Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	204.6600
Water heating fuel used	1150.2026 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)	
mechanical ventilation fans (SFP = 0.5720)	139.2889 (230a)
Total electricity for the above, kWh/year	139.2889 (231)
Electricity for lighting (calculated in Appendix L)	182.6625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2223.0433 (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	-516.2747 (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	234.6146	0.1570	36.8433 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1150.2026	0.1408	161.9882 (264)
Space and water heating			198.8315 (265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.3279	0.1339	-131.0347
PV Unit electricity exported	-1244.7154	0.1242	-154.5316
Total			-285.5663 (269)
Total CO2, kg/year			-41.0499 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.5100 (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	234.6146	1.5813	370.9987 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	1.5208	1749.1725 (278)
Space and water heating			2120.1711 (279)
Pumps, fans and electric keep-hot	139.2889	1.5128	210.7162 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-978.3279	1.4950	-1462.5790
PV Unit electricity exported	-1244.7154	0.4556	-567.1490
Total			-2029.7280 (283)
Total Primary energy kWh/year			581.3332 (286)
Dwelling Primary energy Rate (DPER)			7.2700 (287)

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

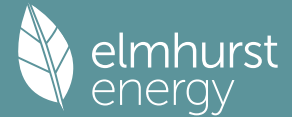
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (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)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1503 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4003 (18)

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Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3403 \quad (21)$$

	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												
Effective ac	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3403	0.3658	0.3828	0.3998 (22b)
	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			2.1200	1.0000	2.1200		(26a)
TER Opening Type (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Floor 1 P/a 0.45			40.0000	0.1300	5.2000		(28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1800	13.6494		(29a)
External Roof 1 Horz	40.0000		40.0000	0.1100	4.4000		(30)
Total net area of external elements Aum(A, m2)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0755		(33)
Party Wall 1			39.9200	0.0000	0.0000		(32)

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

102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0900	0.8982
E5 Ground floor (normal)	18.0000	0.1600	2.8800
E10 Eaves (insulation at ceiling level)	10.0000	0.0600	0.6000
E12 Gable (insulation at ceiling level)	8.0000	0.0600	0.4800
E6 Intermediate floor within a dwelling	18.0000	0.0000	0.0000
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600
E18 Party wall between dwellings	9.9800	0.0600	0.5988
E2 Other lintels (including other steel lintels)	10.6100	0.0500	0.5305
E3 Sill	9.6000	0.0500	0.4800
E4 Jamb	23.1000	0.0500	1.1550

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

Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.2980 (37)

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

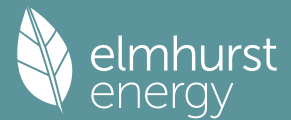
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.1323	38.8916	38.6557	37.5476	37.3403	36.3751	36.3751	36.1964	36.7469	37.3403	37.7597	38.1982 (38)
Average = Sum(39)m / 12 =	87.4303	87.1897	86.9537	85.8456	85.6383	84.6731	84.6731	84.4944	85.0449	85.6383	86.0577	86.4962 (39)
												85.8446

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0899	1.0869	1.0731	1.0705	1.0584	1.0584	1.0562	1.0631	1.0705	1.0757	1.0812 (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													2.4629 (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	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)													106.2689 (43)
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391	(44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801	(45)
Energy content (annual)													Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
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	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	237.6635	210.2523	223.6567	197.4670	191.9516	173.5569	171.7694	178.2888	179.9019	199.8878	211.6491	235.1869	(61)
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	(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	237.6635	210.2523	223.6567	197.4670	191.9516	173.5569	171.7694	178.2888	179.9019	199.8878	211.6491	235.1869	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 2411.2319 (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	2411 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month	104.6920	93.0937	100.0348	90.4987	89.4928	82.5485	82.7823	84.9500	84.6583	92.1316	95.2142	103.8686	(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	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144
Water heating gains (Table 5)	140.7151	138.5323	134.4553	125.6926	120.2861	114.6508	111.2665	114.1800	117.5809	123.8328	132.2420	139.6083
Total internal gains	540.1621	552.7990	530.4412	513.3646	488.6354	469.4091	452.4404	453.0769	466.1181	483.6839	511.4157	529.3730

6. Solar gains

[Jan]	Area		Solar flux		Specific data		FF		Access		Gains	
	m2		Table 6a		or Table 6b		Specific data		factor		W	
			W/m2				or Table 6c		Table 6d			
Northeast	4.4100		11.2829		0.6300		0.7000		0.7700		15.2066	
Southwest	7.5600		36.7938		0.6300		0.7000		0.7700		85.0097	
Solar gains	100.2164	175.7565	253.8942	337.0752	398.0783	404.2283	385.9619	339.0705	282.4830	197.8658	120.9559	85.1691
Total gains	640.3785	728.5555	784.3355	850.4398	886.7137	873.6374	838.4023	792.1474	748.6011	681.5497	632.3716	614.5421

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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	25.9567	26.0283	26.0989	26.4358	26.4998	26.8019	26.8019	26.8586	26.6847	26.4998	26.3707	26.2370
alpha	2.7304	2.7352	2.7399	2.7624	2.7667	2.7868	2.7868	2.7906	2.7790	2.7667	2.7580	2.7491
util living area	0.9380	0.9124	0.8761	0.8027	0.6939	0.5459	0.4174	0.4539	0.6407	0.8237	0.9106	0.9436
MIT	18.7938	19.1010	19.5242	20.0796	20.5314	20.8310	20.9412	20.9243	20.7220	20.1481	19.3979	18.7491
Th 2	20.0067	20.0091	20.0115	20.0229	20.0250	20.0349	20.0349	20.0368	20.0311	20.0250	20.0207	20.0162
util rest of house	0.9294	0.9007	0.8590	0.7752	0.6502	0.4809	0.3348	0.3705	0.5791	0.7932	0.8967	0.9358
MIT 2	17.4437	17.8290	18.3575	19.0423	19.5722	19.9015	20.0012	19.9908	19.7952	19.1400	18.2150	17.3935
Living area fraction	fLA = Living area / (4) =											0.4205
MIT	18.0115	18.3639	18.8481	19.4785	19.9756	20.2924	20.3965	20.3834	20.1850	19.5639	18.7124	17.9635
Temperature adjustment												0.0000
adjusted MIT	18.0115	18.3639	18.8481	19.4785	19.9756	20.2924	20.3965	20.3834	20.1850	19.5639	18.7124	17.9635

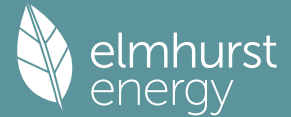
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9069	0.8763	0.8350	0.7578	0.6478	0.4990	0.3666	0.4016	0.5896	0.7765	0.8734	0.9143
Useful gains	580.7904	638.4146	654.9465	644.4744	574.4350	435.9588	307.3788	318.0895	441.3695	529.2511	552.3018	561.8500
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	1198.7971	1173.9095	1073.7117	908.1163	708.7053	481.9900	321.4574	336.5724	517.4940	767.6543	999.3376	1190.4934
Space heating kWh	459.7970	359.8526	311.5613	189.8222	99.8971	0.0000	0.0000	0.0000	0.0000	177.3720	321.8658	467.7107
Space heating requirement - total per year (kWh/year)												2387.8787
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
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	459.7970	359.8526	311.5613	189.8222	99.8971	0.0000	0.0000	0.0000	0.0000	177.3720	321.8658	467.7107
Space heating requirement after solar contribution - total per year (kWh/year)												2387.8787
Space heating per m2												(98c) / (4) = 29.8485

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	459.7970	359.8526	311.5613	189.8222	99.8971	0.0000	0.0000	0.0000	0.0000	177.3720	321.8658	467.7107
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
Space heating fuel (main heating system)	498.1550	389.8728	337.5529	205.6578	108.2309	0.0000	0.0000	0.0000	0.0000	192.1690	348.7170	506.7288
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
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
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
Water heating												235.1869
Water heating requirement	237.6635	210.2523	223.6567	197.4670	191.9516	173.5569	171.7694	178.2888	179.9019	199.8878	211.6491	235.1869
Efficiency of water heater												79.8000

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(217)m	85.5136	85.2540	84.8033	83.9713	82.6679	79.8000	79.8000	79.8000	79.8000	83.7928	84.9971	85.5709	(217)
Fuel for water heating, kWh/month													
	277.9248	246.6188	263.7359	235.1601	232.1961	217.4898	215.2499	223.4195	225.4409	238.5500	249.0074	274.8446	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	24.3235	19.5132	17.5695	12.8722	9.9428	8.1234	9.0702	11.7898	15.3137	20.0924	22.6944	24.9995	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2969	-52.5119	-75.3791	-84.6330	-91.1561	-85.0432	-83.9913	-79.3464	-71.1273	-59.9927	-40.9790	-32.2535	(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	-21.2710	-44.7299	-88.8765	-133.4482	-176.4177	-177.2501	-175.1642	-148.3248	-108.7361	-63.9544	-28.3952	-16.8217	(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												2587.0842	(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												2899.6378	(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)												196.3046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1977.1002	(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												3791.9263	(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	2587.0842	0.2100	543.2877 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2899.6378	0.2100	608.9239 (264)
Space and water heating			1152.2116 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.3046	0.1443	28.3328 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-793.7104	0.1346	-106.8461
PV Unit electricity exported	-1183.3898	0.1259	-148.9938
Total			-255.8399 (269)
Total CO2, kg/year			936.6338 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7100 (273)

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

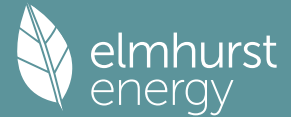
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2587.0842	1.1300	2923.4052 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2899.6378	1.1300	3276.5907 (278)
Space and water heating			6199.9959 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.3046	1.5338	301.0985 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-793.7104	1.4975	-1188.5970
PV Unit electricity exported	-1183.3898	0.4622	-546.9101
Total			-1735.5071 (283)
Total Primary energy kWh/year			4895.6880 (286)
Target Primary Energy Rate (TPER)			61.2000 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

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2. Ventilation rate

												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												3 * 10 =	30.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												30.0000 / (5) =	0.1503 (8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												1.0000 (17)	
Infiltration rate												0.2003 (18)	
Number of sides sheltered												2 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1703 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2171	0.2128	0.2086	0.1873	0.1830	0.1617	0.1617	0.1575	0.1703	0.1830	0.1915	0.2001	(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	0.5236	0.5226	0.5217	0.5175	0.5167	0.5131	0.5131	0.5124	0.5145	0.5167	0.5183	0.5200	(25)

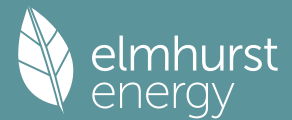
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9700	1.1450	13.7061			(27)					
Door			2.1200	1.0000	2.1200			(26a)					
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000	(28a)					
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700	(29a)					
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000	(30)					
Total net area of external elements Aum(A, m2)			169.9200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	35.6006		(33)					
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)					
Internal Wall 1 GF			34.1300			9.0000	307.1700	(32c)					
Internal Wall 2 FF			60.2000			9.0000	541.8000	(32c)					
Internal Floor 1			40.0000			18.0000	720.0000	(32d)					
Internal Ceiling 1			40.0000			9.0000	360.0000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	8169.8400		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							102.1230	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E16 Corner (normal)				9.9800	0.0300	0.2994							
E5 Ground floor (normal)				18.0000	0.0210	0.3780							
E10 Eaves (insulation at ceiling level)				10.0000	0.0440	0.4400							
E12 Gable (insulation at ceiling level)				8.0000	0.0510	0.4080							
E6 Intermediate floor within a dwelling				18.0000	0.0800	1.4400							
P1 Party wall - Ground floor				8.0000	0.1490	1.1920							
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000	0.0000							
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800	3.8400							
E18 Party wall between dwellings				9.9800	0.0395	0.3942							
E2 Other lintels (including other steel lintels)				10.6100	0.0840	0.8912							
E3 Sill				9.6000	0.0430	0.4128							
E4 Jamb				23.1000	0.0340	0.7854							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.4810	(36)				
Point Thermal bridges								(36a) =	0.0000				
Total fabric heat loss								(33) + (36) + (36a) =	46.0817	(37)			
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	34.4859	34.4256	34.3666	34.0891	34.0372	33.7956	33.7956	33.7508	33.8887	34.0372	34.1422	34.2520	(38)
Average = Sum(39)m / 12 =	80.5676	80.5073	80.4482	80.1708	80.1189	79.8772	79.8772	79.8325	79.9703	80.1189	80.2239	80.3337	(39)
													80.1705
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0071	1.0063	1.0056	1.0021	1.0015	0.9985	0.9985	0.9979	0.9996	1.0015	1.0028	1.0042	(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													2.4629	(42)
Hot water usage for mixer showers													0.0000	(42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)	
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)	
Average daily hot water use (litres/day)													62.4644	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy conte	68.1485	66.2791	64.2381	61.6978	59.4316	57.0764	56.5871	58.6239	60.7129	63.1315	65.6943	68.0528	(44)	
Energy content (annual)	107.9305	94.3805	98.7316	84.4612	80.0063	70.1821	68.4372	72.5886	74.8651	85.6688	93.5935	106.5542	(45)	
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m =	1037.3997

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Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711	881.7897	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711	881.7897	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =												882	(64)
Electric shower(s)	52.4656	46.7473	51.0463	48.7128	49.6269	47.3393	48.9172	49.6269	48.7128	51.0463	50.0864	52.4656	596.7935	(64a)
Heat gains from water heating, kWh/month	36.0516	31.7427	33.7420	30.1262	29.4081	26.7485	26.7722	27.8318	28.0870	30.9662	32.4102	35.7592		(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	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	48.4565	47.2361	45.3522	41.8420	39.5270	37.1507	35.9841	37.4083	39.0098	41.6212	45.0142	48.0634	(72)
Total internal gains	444.9035	458.5028	438.3381	426.5140	404.8763	391.9091	377.1581	376.3052	387.5470	398.4723	421.1879	434.8282	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	4.4100	11.2829	0.7600	0.7000	0.7700	18.3445 (75)							
Southwest	7.5600	36.7938	0.7600	0.7000	0.7700	102.5514 (79)							
Solar gains	120.8959	212.0238	306.2851	406.6304	480.2215	487.6405	465.6048	409.0375	340.7732	238.6953	145.9151	102.7437	(83)
Total gains	565.7995	670.5266	744.6232	833.1444	885.0978	879.5496	842.7629	785.3426	728.3201	637.1676	567.1030	537.5718	(84)

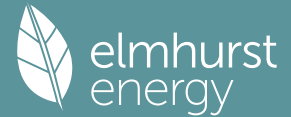
7. Mean internal temperature (heating season)

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	28.1677	28.1887	28.2094	28.3071	28.3254	28.4111	28.4111	28.4270	28.3780	28.3254	28.2883	28.2497	
alpha	2.8778	2.8792	2.8806	2.8871	2.8884	2.8941	2.8941	2.8951	2.8919	2.8884	2.8859	2.8833	
util living area	0.9504	0.9216	0.8797	0.7963	0.6759	0.5236	0.3970	0.4385	0.6330	0.8326	0.9247	0.9564	(86)
MIT	18.8625	19.2047	19.6458	20.1870	20.6106	20.8656	20.9552	20.9394	20.7592	20.1973	19.4345	18.7869	(87)
Th 2	20.0774	20.0781	20.0787	20.0816	20.0821	20.0846	20.0846	20.0851	20.0836	20.0821	20.0810	20.0799	(88)
util rest of house	0.9435	0.9112	0.8636	0.7693	0.6335	0.4625	0.3212	0.3606	0.5739	0.8041	0.9130	0.9504	(89)
MIT 2	18.1263	18.4608	18.8891	19.4042	19.7881	20.0014	20.0643	20.0560	19.9231	19.4262	18.6932	18.0539	(90)
Living area fraction	FLA = Living area / (4) =												
MIT	18.4359	18.7736	19.2073	19.7334	20.1339	20.3648	20.4389	20.4275	20.2747	19.7504	19.0049	18.3621	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.4359	18.7736	19.2073	19.7334	20.1339	20.3648	20.4389	20.4275	20.2747	19.7504	19.0049	18.3621	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	525.0734	598.9762	629.9173	631.5032	562.9282	423.8097	295.9766	306.7564	427.5031	504.8895	508.1385	503.0439	(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	1138.8936	1116.9279	1022.2766	868.5192	675.7170	460.4770	306.6436	321.5215	493.7917	733.1236	955.0558	1137.6940	(97)
Space heating kWh	456.6822	348.0636	291.9153	170.6516	83.9149	0.0000	0.0000	0.0000	0.0000	169.8061	321.7805	472.1797	(98a)
Space heating requirement - total per year (kWh/year)	2314.9939												
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	456.6822	348.0636	291.9153	170.6516	83.9149	0.0000	0.0000	0.0000	0.0000	169.8061	321.7805	472.1797	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	2314.9939												
Space heating per m2	(98c) / (4) =												
	28.9374 (99)												

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8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	750.8460	591.0915	606.7269	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8319	0.8835	0.8596	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	624.6509	522.2133	521.5452	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh						978.3372	937.7884	873.0146	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	254.6541	309.1879	261.4932	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh						63.6635	77.2970	65.3733	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												206.3338 (107)
Energy for space heating												28.9374 (99)
Energy for space cooling												2.5792 (108)
Total												31.5166 (109)
Fabric Energy Efficiency (DFEE)												31.5 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 199.6000 (5)

2. Ventilation rate

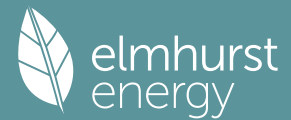
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1503 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4003 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3403 (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	0.4338	0.4253	0.4168	0.3743	0.3658	0.3232	0.3232	0.3147	0.3403	0.3658	0.3828	0.3998 (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	0.5941	0.5904	0.5869	0.5700	0.5669	0.5522	0.5522	0.5495	0.5579	0.5669	0.5733	0.5799 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Semi-glazed door			2.1200	1.0000	2.1200		(26a)
TER Opening Type (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Floor 1 P/a 0.45			40.0000	0.1300	5.2000		(28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1800	13.6494		(29a)
External Roof 1 Horz	40.0000		40.0000	0.1100	4.4000		(30)
Total net area of external elements Aum(A, m2)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.0755		(33)
Party Wall 1			39.9200	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							102.1230 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				9.9800	0.0900	0.8982	
E5 Ground floor (normal)				18.0000	0.1600	2.8800	
E10 Eaves (insulation at ceiling level)				10.0000	0.0600	0.6000	
E12 Gable (insulation at ceiling level)				8.0000	0.0600	0.4800	
E6 Intermediate floor within a dwelling				18.0000	0.0000	0.0000	
P1 Party wall - Ground floor				8.0000	0.0800	0.6400	

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P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600
E18 Party wall between dwellings	9.9800	0.0600	0.5988
E2 Other lintels (including other steel lintels)	10.6100	0.0500	0.5305
E3 Sill	9.6000	0.0500	0.4800
E4 Jamb	23.1000	0.0500	1.1550

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 9.2225 (36)
 Total fabric heat loss (33) + (36) + (36a) = 48.2980 (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	39.1323	38.8916	38.6557	37.5476	37.3403	36.3751	36.3751	36.1964	36.7469	37.3403	37.7597	38.1982 (38)
Average = Sum(39)m / 12 =	87.4303	87.1897	86.9537	85.8456	85.6383	84.6731	84.6731	84.4944	85.0449	85.6383	86.0577	86.4962 (39)
												85.8446

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0929	1.0899	1.0869	1.0731	1.0705	1.0584	1.0584	1.0562	1.0631	1.0705	1.0757	1.0812 (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													2.4629 (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	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	28.2006 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	39.8522 (42c)
Average daily hot water use (litres/day)													62.4644 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	68.1485	66.2791	64.2381	61.6978	59.4316	57.0764	56.5871	58.6239	60.7129	63.1315	65.6943	68.0528 (44)	
Energy content (annual)	107.9305	94.3805	98.7316	84.4612	80.0063	70.1821	68.4372	72.5886	74.8651	85.6688	93.5935	106.5542 (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	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711 (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	91.7409	80.2234	83.9218	71.7920	68.0054	59.6548	58.1716	61.7003	63.6353	72.8185	79.5545	90.5711 (64)	
12Total per year (kWh/year)													881.7897 (64)
Electric shower(s)	52.4656	46.7473	51.0463	48.7128	49.6269	47.3393	48.9172	49.6269	48.7128	51.0463	50.0864	52.4656	52.4656 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													596.7935 (64a)
Heat gains from water heating, kWh/month	36.0516	31.7427	33.7420	30.1262	29.4081	26.7485	26.7722	27.8318	28.0870	30.9662	32.4102	35.7592 (65)	

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

Metabolic gains (Table 5), Watts													
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.0636	129.6061	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636	120.9657	117.0636	120.9657	117.0636	117.0636 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	209.7582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143 (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	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	48.4565	47.2361	45.3522	41.8420	39.5270	37.1507	35.9841	37.4083	39.0098	41.6212	45.0142	48.0634	48.0634 (72)
Total internal gains	444.9035	458.5028	438.3381	426.5140	404.8763	391.9091	377.1581	376.3052	387.5470	398.4723	421.1879	434.8282	434.8282 (73)

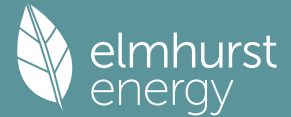
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	4.4100	11.2829	0.6300	0.7000	0.7700	15.2066 (75)						
Southwest	7.5600	36.7938	0.6300	0.7000	0.7700	85.0097 (79)						
Solar gains	100.2164	175.7565	253.8942	337.0752	398.0783	404.2283	385.9619	339.0705	282.4830	197.8658	120.9559	85.1691 (83)
Total gains	545.1199	634.2593	692.2323	763.5892	802.9546	796.1374	763.1200	715.3757	670.0300	596.3381	542.1439	519.9973 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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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	25.9567	26.0283	26.0989	26.4358	26.4998	26.8019	26.8019	26.8586	26.6847	26.4998	26.3707	26.2370
alpha	2.7304	2.7352	2.7399	2.7624	2.7667	2.7868	2.7868	2.7906	2.7790	2.7667	2.7580	2.7491
util living area	0.9564	0.9342	0.9024	0.8349	0.7315	0.5837	0.4519	0.4931	0.6849	0.8602	0.9350	0.9611 (86)
MIT	18.5902	18.9154	19.3636	19.9630	20.4591	20.7993	20.9281	20.9066	20.6682	20.0229	19.2199	18.5426 (87)
Th 2	20.0067	20.0091	20.0115	20.0229	20.0250	20.0349	20.0349	20.0368	20.0311	20.0250	20.0207	20.0162 (88)
util rest of house	0.9500	0.9249	0.8881	0.8101	0.6895	0.5175	0.3647	0.4054	0.6243	0.8338	0.9242	0.9554 (89)
MIT 2	17.8109	18.1313	18.5707	19.1536	19.6128	19.9097	20.0023	19.9918	19.8078	19.2232	18.4432	17.7706 (90)
Living area fraction									FLA = Living area / (4) =			0.4205 (91)
MIT	18.1386	18.4610	18.9041	19.4939	19.9687	20.2838	20.3916	20.3765	20.1696	19.5595	18.7698	18.0952 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1386	18.4610	18.9041	19.4939	19.9687	20.2838	20.3916	20.3765	20.1696	19.5595	18.7698	18.0952 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9343	0.9065	0.8687	0.7947	0.6868	0.5354	0.3980	0.4376	0.6337	0.8190	0.9068	0.9407 (94)
Useful gains	509.3310	574.9449	601.3671	606.8070	551.4850	426.2819	303.7372	313.0584	424.6072	488.4234	491.5998	489.1838 (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	1209.9118	1182.3777	1078.5840	909.4413	708.1136	481.2641	321.0448	335.9928	516.1902	767.2751	1004.2757	1201.8849 (97)
Space heating kWh	521.2321	408.1949	355.0494	217.8967	116.5317	0.0000	0.0000	0.0000	0.0000	207.4657	369.1266	530.2496 (98a)
Space heating requirement - total per year (kWh/year)												2725.7467
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	521.2321	408.1949	355.0494	217.8967	116.5317	0.0000	0.0000	0.0000	0.0000	207.4657	369.1266	530.2496 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2725.7467
Space heating per m2												(98c) / (4) = 34.0718 (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	795.9276	626.5813	642.1576	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7720	0.8342	0.8076	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	614.4676	522.6728	518.5770	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.8425	844.6992	791.2351	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	191.7899	239.5877	202.8576	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	47.9475	59.8969	50.7144	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												158.5588 (107)
Energy for space heating												34.0718 (99)
Energy for space cooling												1.9820 (108)
Total												36.0538 (109)
Fabric Energy Efficiency (TFEE)												36.1 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	199.6000 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door

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Measured/design AP50													1.0000 (17)
Infiltration rate													0.0500 (18)
Number of sides sheltered													2 (19)
Shelter factor													(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) = 0.0425 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Balanced mechanical ventilation with heat recovery	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499	(22b)
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													81.0000 (23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449	(25)

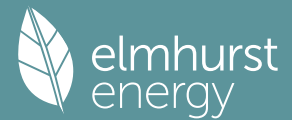
3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9700	1.1450	13.7061			(27)					
Door			2.1200	1.0000	2.1200			(26a)					
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000	(28a)					
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700	(29a)					
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000	(30)					
Total net area of external elements Aum (A, m2)			169.9200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 35.6006			(33)					
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)					
Internal Wall 1 GF			34.1300			9.0000	307.1700	(32c)					
Internal Wall 2 FF			60.2000			9.0000	541.8000	(32c)					
Internal Floor 1			40.0000			18.0000	720.0000	(32d)					
Internal Ceiling 1			40.0000			9.0000	360.0000	(32e)					
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8169.8400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							102.1230	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E16 Corner (normal)				9.9800	0.0300		0.2994						
E5 Ground floor (normal)				18.0000	0.0210		0.3780						
E10 Eaves (insulation at ceiling level)				10.0000	0.0440		0.4400						
E12 Gable (insulation at ceiling level)				8.0000	0.0510		0.4080						
E6 Intermediate floor within a dwelling				18.0000	0.0800		1.4400						
P1 Party wall - Ground floor				8.0000	0.1490		1.1920						
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000		0.0000						
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800		3.8400						
E18 Party wall between dwellings				9.9800	0.0395		0.3942						
E2 Other lintels (including other steel lintels)				10.6100	0.0840		0.8912						
E3 Sill				9.6000	0.0430		0.4128						
E4 Jamb				23.1000	0.0340		0.7854						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4810	(36)					
Point Thermal bridges							(36a) = 0.0000						
Total fabric heat loss							(33) + (36) + (36a) = 46.0817	(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	9.8267	9.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467	(38)
Average = Sum(39)m / 12 =	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284	(39)
HLP	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	0.6954	(40)
HLP (average)												0.6925	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4629 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													75.5424 (42b)
Hot water usage for other uses													39.8522 (42c)
Average daily hot water use (litres/day)													36.9538 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391	(44)
Energy content (annual)	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 1764.7487
Water storage loss:	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420	(46)
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265	(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)

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Output from w/h	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (64)
	Total per year (kWh/year) = Sum(64)m = 2354.0047 (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	100.8037	89.5817	96.1465	86.7358	85.6045	78.7857	78.8940	81.0616	80.8954	88.2433	91.4513	99.9802 (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
	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8578	22.9666	18.6777	14.1402	10.5700	8.9236	9.6423	12.5334	16.8223	21.3598	24.9301	26.5764 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5232	330.9219	322.3573	304.1245	281.1088	259.4772	245.0260	241.6274	250.1919	268.4248	291.4405	313.0720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400 (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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	135.4889	133.3061	129.2291	120.4664	115.0598	109.4245	106.0403	108.9538	112.3547	118.6066	127.0158	134.3821 (72)
Total internal gains	590.3671	588.6919	571.7614	540.2283	508.2358	479.3226	462.2058	464.6119	480.8662	509.8884	544.8836	575.5277 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	4.4100	11.2829	0.7600	0.7000	0.7700	18.3445 (75)						
Southwest	7.5600	36.7938	0.7600	0.7000	0.7700	102.5514 (79)						
Solar gains	120.8959	212.0238	306.2851	406.6304	480.2215	487.6405	465.6048	409.0375	340.7732	238.6953	145.9151	102.7437 (83)
Total gains	711.2630	800.7156	878.0465	946.8588	988.4573	966.9632	927.8107	873.6493	821.6393	748.5837	690.7987	678.2714 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	3.7061	3.7095	3.7129	3.7300	3.7335	3.7509	3.7509	3.7544	3.7439	3.7335	3.7266	3.7197
util living area	0.8797	0.8307	0.7542	0.6373	0.4979	0.3587	0.2596	0.2873	0.4488	0.6753	0.8296	0.8932 (86)
Living	20.2293	20.3947	20.5900	20.7670	20.8668	20.9063	20.9152	20.9140	20.8913	20.7605	20.4738	20.1823
Non living	19.4346	19.6370	19.8724	20.0823	20.1932	20.2371	20.2448	20.2447	20.2220	20.0803	19.7409	19.3797
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	20.6057	20.3947	20.5900	20.7670	20.8668	20.9063	20.9152	20.9140	20.8913	20.7605	20.4738	20.2967 (87)
Th 2	20.3418	20.3426	20.3434	20.3473	20.3480	20.3519	20.3519	20.3527	20.3504	20.3480	20.3465	20.3449 (88)
util rest of house	0.8681	0.8158	0.7345	0.6116	0.4670	0.3238	0.2218	0.2475	0.4099	0.6455	0.8122	0.8827 (89)
MIT 2	19.9802	19.6370	19.8724	20.0823	20.1932	20.2371	20.2448	20.2447	20.2220	20.0803	19.7409	19.5536 (90)
Living area fraction	FLA = Living area / (4) = 0.4205 (91)											
MIT	20.2432	19.9556	20.1742	20.3702	20.4764	20.5185	20.5267	20.5262	20.5035	20.3663	20.0491	19.8661 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.2432	19.9556	20.1742	20.3702	20.4764	20.5185	20.5267	20.5262	20.5035	20.3663	20.0491	19.8661 (93)

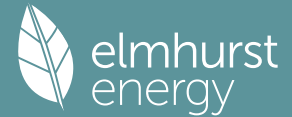
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	616.1099	645.7041	640.1989	579.9450	467.7235	321.8516	215.2609	225.5840	344.3954	483.8683	555.1666	592.9345 (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	891.3589	840.6795	762.5851	635.6630	485.7609	325.5092	215.9609	226.6447	353.0777	540.5507	718.5253	871.4800 (97)
Space heating kWh	204.7853	131.0235	91.0553	40.1169	13.4198	0.0000	0.0000	0.0000	0.0000	42.1717	117.6183	207.2378 (98a)
Space heating requirement - total per year (kWh/year)	847.4286											
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	204.7853	131.0235	91.0553	40.1169	13.4198	0.0000	0.0000	0.0000	0.0000	42.1717	117.6183	207.2378 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	847.4286											
Space heating per m2	(98c) / (4) = 10.5929 (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 %)	400.0453 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Space heating efficiency (main heating system 1)	204.7853	131.0235	91.0553	40.1169	13.4198	0.0000	0.0000	0.0000	0.0000	42.1717	117.6183	207.2378	(98)
Space heating fuel (main heating system)	400.0453	400.0453	400.0453	400.0453	400.0453	0.0000	0.0000	0.0000	0.0000	400.0453	400.0453	400.0453	(210)
Space heating efficiency (main heating system 2)	51.1905	32.7522	22.7613	10.0281	3.3546	0.0000	0.0000	0.0000	0.0000	10.5417	29.4012	51.8036	(211)
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	(212)
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	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265	(64)
Efficiency of water heater (217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(216)
Fuel for water heating, kWh/month	113.7512	100.5875	106.9072	94.1871	91.4156	82.5043	81.5543	84.7398	85.6045	95.2934	101.1167	112.5410	(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	11.8300	10.6852	11.8300	11.4484	11.8300	11.4484	11.8300	11.8300	11.4484	11.8300	11.4484	11.8300	(231)
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-41.4783	-61.2170	-92.0256	-106.5051	-116.9270	-109.5834	-108.1057	-101.1305	-87.8308	-71.0155	-46.2543	-35.4399	(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	-18.0317	-40.8011	-87.7552	-141.2774	-193.7130	-197.3280	-194.1408	-160.1991	-112.2678	-61.1554	-24.8961	-13.9645	(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												211.8332	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												204.6600	(216)
Water heating fuel used												1150.2026	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												139.2889	(230a)
Total electricity for the above, kWh/year												139.2889	(231)
Electricity for lighting (calculated in Appendix L)												182.6625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2223.0433	(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												-539.0561	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	211.8332	16.4900	34.9313	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1150.2026	16.4900	189.6684	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	139.2889	16.4900	22.9687	(249)
Energy for lighting	182.6625	16.4900	30.1210	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-977.5132	16.4900	-161.1919	
PV Unit electricity exported	-1245.5301	5.5900	-69.6251	
Total			-230.8171	(252)
Total energy cost			46.8724	(255)

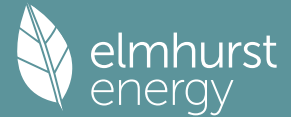
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)		0.1350	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	97.8118	
SAP rating (Section 12)		98	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	211.8332	0.1570	33.2609	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1150.2026	0.1408	161.9882	(264)
Space and water heating			195.2492	(265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211	(267)
Energy for lighting	182.6625	0.1443	26.3638	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-977.5132	0.1339	-130.9111	

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PV Unit electricity exported	-1245.5301	0.1242	-154.6716
Total			-285.5827 (269)
Total CO2, kg/year			-44.6486 (272)
CO2 emissions per m2			-0.5600 (273)
EI value			100.4786
EI rating			100 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

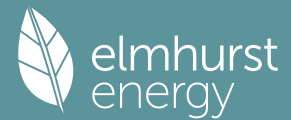
2. Ventilation rate

	m3 per hour												
Number of open chimneys	0 * 80 =											0.0000 (6a)	
Number of open flues	0 * 20 =											0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)	
Number of blocked chimneys	0 * 20 =											0.0000 (6f)	
Number of intermittent extract fans	0 * 10 =											0.0000 (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)	0.0000 / (5) =											0.0000 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												1.0000 (17)	
Infiltration rate												0.0500 (18)	
Number of sides sheltered												2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0425 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(22)
	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000	
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250	(22a)
Adj infilt rate	0.0701	0.0659	0.0648	0.0595	0.0584	0.0499	0.0489	0.0478	0.0531	0.0616	0.0638	0.0691	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													81.0000 (23c)
Effective ac	0.1651	0.1609	0.1598	0.1545	0.1534	0.1449	0.1439	0.1428	0.1481	0.1566	0.1587	0.1641	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m2)			169.9200				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	35.6006			
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			8169.8400 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					102.1230 (35)		
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				9.9800	0.0300	0.2994	
E5 Ground floor (normal)				18.0000	0.0210	0.3780	
E10 Eaves (insulation at ceiling level)				10.0000	0.0440	0.4400	
E12 Gable (insulation at ceiling level)				8.0000	0.0510	0.4080	
E6 Intermediate floor within a dwelling				18.0000	0.0800	1.4400	
P1 Party wall - Ground floor				8.0000	0.1490	1.1920	
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800	3.8400	
E18 Party wall between dwellings				9.9800	0.0395	0.3942	
E2 Other lintels (including other steel lintels)				10.6100	0.0840	0.8912	
E3 Sill				9.6000	0.0430	0.4128	
E4 Jamb				23.1000	0.0340	0.7854	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4810 (36)

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Point Thermal bridges														(36a) =	0.0000
Total fabric heat loss														(33) + (36) + (36a) =	46.0817 (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	10.8765	10.5965	10.5265	10.1766	10.1066	9.5467	9.4768	9.4068	9.7567	10.3166	10.4565	10.8065	(38)		
Average = Sum(39)m / 12 =	56.9581	56.6782	56.6082	56.2583	56.1883	55.6284	55.5584	55.4884	55.8384	56.3982	56.5382	56.8881	(39)		
	56.9581	56.6782	56.6082	56.2583	56.1883	55.6284	55.5584	55.4884	55.8384	56.3982	56.5382	56.8881	(39)		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	0.7120	0.7085	0.7076	0.7032	0.7024	0.6954	0.6945	0.6936	0.6980	0.7050	0.7067	0.7111	(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															2.4629 (42)
Hot water usage for mixer showers															
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)		
Hot water usage for other uses	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870	(42b)		
Average daily hot water use (litres/day)	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)		
	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)	106.2689 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Energy conte	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391	(44)		
Energy content (annual)	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801	(45)		
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420	(46)		
Water storage loss:															
Store volume															250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):															1.6000 (48)
Temperature factor from Table 2b															0.5400 (49)
Enter (49) or (54) in (55)															0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)		
If cylinder contains dedicated solar storage															
Primary loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)		
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)		
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)		
WWHRS	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265	(62)		
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)		
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)		
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)		
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)		
Electric shower(s)															
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)		
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	100.8037	89.5817	96.1465	86.7358	85.6045	78.7857	78.8940	81.0616	80.8954	88.2433	91.4513	99.9802	(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	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	(66)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	25.8578	22.9666	18.6777	14.1402	10.5700	8.9236	9.6423	12.5334	16.8223	21.3598	24.9301	26.5764	(67)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	327.5232	330.9219	322.3573	304.1245	281.1088	259.4772	245.0260	241.6274	250.1919	268.4248	291.4405	313.0720	(68)		
Pumps, fans	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	(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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)		
Total internal gains	135.4889	133.3061	129.2291	120.4664	115.0598	109.4245	106.0403	108.9538	112.3547	118.6066	127.0158	134.3821	(72)		
	590.3671	588.6919	571.7614	540.2283	508.2358	479.3226	462.2058	464.6119	480.8662	509.8884	544.8836	575.5277	(73)		

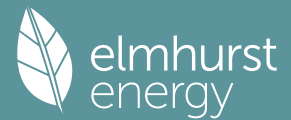
6. Solar gains

[Jan]															
		Area	Solar flux	g	FF	Access	Gains								
		m2	Table 6a	Specific data	Specific data	factor	W								
			W/m2	or Table 6b	or Table 6c	Table 6d									
Northeast		4.4100	15.8649	0.7600	0.7000	0.7700	25.7941	(75)							
Southwest		7.5600	48.0626	0.7600	0.7000	0.7700	133.9596	(79)							
Solar gains	159.7537	241.9825	347.4510	476.3894	536.4903	595.5914	513.2000	483.6134	407.1773	281.5525	184.9883	131.6282	(83)		
Total gains	750.1208	830.6744	919.2124	1016.6177	1044.7261	1074.9141	975.4059	948.2253	888.0434	791.4410	729.8719	707.1560	(84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)															21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)															
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
alpha	39.8433	40.0401	40.0896	40.3390	40.3892	40.7957	40.8471	40.8986	40.6423	40.2388	40.1392	39.8923			
	3.6562	3.6693	3.6726	3.6893	3.6926	3.7197	3.7231	3.7266	3.7095	3.6826	3.6759	3.6595			

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util living area	0.8086	0.7586	0.6880	0.5828	0.4663	0.3325	0.2718	0.2734	0.3825	0.5694	0.7272	0.8138 (86)
Living	20.4918	20.5905	20.6984	20.8074	20.8752	20.9077	20.9137	20.9138	20.9024	20.8396	20.6881	20.5009
Non living	19.7471	19.8659	19.9916	20.1182	20.1924	20.2309	20.2371	20.2380	20.2243	20.1558	19.9857	19.7604
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	20.7400	20.5905	20.6984	20.8074	20.8752	20.9077	20.9137	20.9138	20.9024	20.8396	20.6881	20.5707 (87)
Th 2	20.3303	20.3334	20.3341	20.3380	20.3388	20.3449	20.3457	20.3465	20.3426	20.3364	20.3349	20.3310 (88)
util rest of house	0.7900	0.7375	0.6639	0.5555	0.4354	0.3000	0.2353	0.2359	0.3439	0.5332	0.7002	0.7947 (89)
MIT 2	20.0978	19.8659	19.9916	20.1182	20.1924	20.2309	20.2371	20.2380	20.2243	20.1558	19.9857	19.8632 (90)
Living area fraction									fLA = Living area / (4) =			0.4205 (91)
MIT	20.3679	20.1706	20.2888	20.4080	20.4796	20.5155	20.5216	20.5222	20.5094	20.4434	20.2811	20.1607 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3679	20.1706	20.2888	20.4080	20.4796	20.5155	20.5216	20.5222	20.5094	20.4434	20.2811	20.1607 (93)

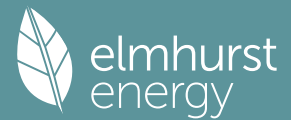
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7911	0.7321	0.6622	0.5585	0.4420	0.3085	0.2451	0.2461	0.3538	0.5392	0.6979	0.7895 (94)
Useful gains	593.3891	608.1651	608.7077	567.7350	461.8130	331.6193	239.1206	233.3173	314.1973	426.7089	509.3499	558.2660 (95)
Ext temp.	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000 (96)
Heat loss rate W	761.4077	729.4823	689.9845	608.0414	476.4516	334.6336	240.1015	234.2820	318.8052	453.6318	592.5799	714.5547 (97)
Space heating kWh	125.0059	81.5252	60.4700	29.0206	10.8911	0.0000	0.0000	0.0000	0.0000	20.0306	59.9256	116.2788 (98a)
Space heating requirement - total per year (kWh/year)												503.1477
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	125.0059	81.5252	60.4700	29.0206	10.8911	0.0000	0.0000	0.0000	0.0000	20.0306	59.9256	116.2788 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												503.1477
Space heating per m2												6.2893 (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 %)												400.2851 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	125.0059	81.5252	60.4700	29.0206	10.8911	0.0000	0.0000	0.0000	0.0000	20.0306	59.9256	116.2788 (98)
Space heating efficiency (main heating system 1)	400.2851	400.2851	400.2851	400.2851	400.2851	0.0000	0.0000	0.0000	0.0000	400.2851	400.2851	400.2851 (210)
Space heating fuel (main heating system)	31.2292	20.3668	15.1067	7.2500	2.7208	0.0000	0.0000	0.0000	0.0000	5.0041	14.9707	29.0490 (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	232.8031	205.8623	218.7963	192.7634	187.0912	168.8533	166.9090	173.4284	175.1982	195.0274	206.9455	230.3265 (64)
Efficiency of water heater												204.6600 (216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600 (217)
Fuel for water heating, kWh/month	113.7512	100.5875	106.9072	94.1871	91.4156	82.5043	81.5543	84.7398	85.6045	95.2934	101.1167	112.5410 (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	11.8300	10.6852	11.8300	11.4484	11.8300	11.4484	11.8300	11.4484	11.8300	11.4484	11.8300	11.8300 (231)
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-52.7720	-68.3802	-100.7107	-116.5839	-123.5463	-119.8836	-113.2134	-110.3132	-98.0808	-80.4253	-56.3642	-44.1815 (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	-28.6216	-51.8683	-108.3116	-177.4842	-225.0906	-255.5678	-220.8712	-201.4735	-145.8547	-80.2224	-36.9670	-21.3400 (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												125.6973 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												204.6600
Water heating fuel used												1150.2026 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												139.2889 (230a)
Total electricity for the above, kWh/year												139.2889 (231)
Electricity for lighting (calculated in Appendix L)												182.6625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2638.1280 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)

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Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	-1040.2766 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	125.6973	25.1600	31.6255 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	25.1600	289.3910 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	139.2889	25.1600	35.0451 (249)
Energy for lighting	182.6625	25.1600	45.9579 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1084.4553	25.1600	-272.8489
PV Unit electricity exported	-1553.6727	5.8100	-90.2684
Total			-363.1173 (252)
Total energy cost			38.9021 (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	125.6973	0.1570	19.7324 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1150.2026	0.1408	161.9882 (264)
Space and water heating			181.7206 (265)
Pumps, fans and electric keep-hot	139.2889	0.1387	19.3211 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1084.4553	0.1345	-145.8551
PV Unit electricity exported	-1553.6727	0.1251	-194.3246
Total			-340.1797 (269)
Total CO2, kg/year			-112.7741 (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	125.6973	1.5811	198.7443 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1150.2026	1.5208	1749.1725 (278)
Space and water heating			1947.9168 (279)
Pumps, fans and electric keep-hot	139.2889	1.5128	210.7162 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1084.4553	1.4971	-1623.4888
PV Unit electricity exported	-1553.6727	0.4591	-713.2807
Total			-2336.7694 (283)
Total Primary energy kWh/year			102.0374 (286)

SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

Current energy efficiency rating:	A 98
Current environmental impact rating:	A 100

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.7	-£ 69	-40 kg (35.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£69	0.50 kg/m²	A 99 A 101
Total Savings	£69	0.50 kg/m²	

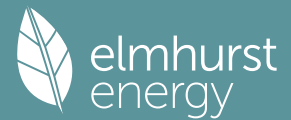
Potential energy efficiency rating:	A 99
Potential environmental impact rating:	A 101

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
	£402	£321	£81
Electricity			
Space heating	£67	£87	-£20
Water heating	£289	£188	£102
Lighting	£46	£46	£0
Generated (PV)	-£363	-£351	-£12
Total cost of fuels	£39	-£30	£69
Total cost of uses	£39	-£30	£70

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Delivered energy	-13 kWh/m ²	-17 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	-0.1 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-1 kg/m ²	-2 kg/m ²	1 kg/m ²
Primary energy	1 kWh/m ²	-4 kWh/m ²	5 kWh/m ²

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 199.6000 (5)

2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (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) =	0.0000 / (5) =	0.0000 (8)										
Pressure test		Yes										
Pressure Test Method		Blower Door										
Measured/design AP50		1.0000 (17)										
Infiltration rate		0.0500 (18)										
Number of sides sheltered		2 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0425 (21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.0000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (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
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m ²)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6006		(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8169.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							102.1230 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				9.9800	0.0300	0.2994	
E5 Ground floor (normal)				18.0000	0.0210	0.3780	
E10 Eaves (insulation at ceiling level)				10.0000	0.0440	0.4400	
E12 Gable (insulation at ceiling level)				8.0000	0.0510	0.4080	
E6 Intermediate floor within a dwelling				18.0000	0.0800	1.4400	
P1 Party wall - Ground floor				8.0000	0.1490	1.1920	
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.4800	3.8400	
E18 Party wall between dwellings				9.9800	0.0395	0.3942	
E2 Other lintels (including other steel lintels)				10.6100	0.0840	0.8912	
E3 Sill				9.6000	0.0430	0.4128	
E4 Jamb				23.1000	0.0340	0.7854	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4810 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	46.0817 (37)

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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	9.8267	9.7567	9.6867	9.3368	9.2668	8.9169	8.9169	8.8469	9.0569	9.2668	9.4068	9.5467 (38)
Average = Sum(39)m / 12 =	55.9083	55.8384	55.7684	55.4184	55.3485	54.9985	54.9985	54.9286	55.1385	55.3485	55.4884	55.6284 (39)
HLP	0.6989	0.6980	0.6971	0.6927	0.6919	0.6875	0.6875	0.6866	0.6892	0.6919	0.6936	0.6954 (40)
HLP (average)												0.6925
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4629 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)													106.2689 (43)
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391	(44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801	(45)
Energy content (annual)													Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420	(46)
Water storage loss:													250.0000 (47)
Store volume													1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.8640 (55)
Enter (49) or (54) in (55)													
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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	232.8031	205.8623	217.4006	186.0098	174.2969	156.2465	153.8821	161.3320	169.7954	193.6317	206.9455	230.3265	(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													599.3060 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													599.3060
Solar input	-0.0000	-16.2478	-57.1859	-77.6199	-99.9149	-91.8832	-91.1420	-80.4420	-56.3516	-28.5186	-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	232.8031	189.6145	160.2146	108.3899	74.3819	64.3633	62.7401	80.8900	113.4438	165.1131	206.9455	230.3265	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	100.8037	89.5817	95.0299	81.3329	75.3691	68.7003	68.4724	71.3845	76.5731	87.1267	91.4513	99.9802	(65)

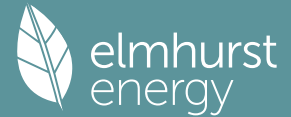
5. Internal gains (see Table 5 and 5a)

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	25.8578	22.9666	18.6777	14.1402	10.5700	8.9236	9.6423	12.5334	16.8223	21.3598	24.9301	26.5764	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5232	330.9219	322.3573	304.1245	281.1088	259.4772	245.0260	241.6274	250.1919	268.4248	291.4405	313.0720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	(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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	135.4889	133.3061	127.7283	112.9624	101.3025	95.4171	92.0328	95.9469	106.3515	117.1058	127.0158	134.3821	(72)
Total internal gains	590.3671	588.6919	570.2606	532.7243	494.4785	465.3152	448.1984	451.6049	474.8630	508.3876	544.8836	575.5277	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	4.4100	11.2829	0.7600	0.7000	0.7700	18.3445 (75)
Southwest	7.5600	36.7938	0.7600	0.7000	0.7700	102.5514 (79)

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Solar gains	120.8959	212.0238	306.2851	406.6304	480.2215	487.6405	465.6048	409.0375	340.7732	238.6953	145.9151	102.7437 (83)
Total gains	711.2630	800.7156	876.5457	939.3548	974.7000	952.9557	913.8032	860.6424	815.6361	747.0829	690.7987	678.2714 (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	40.5914	40.6423	40.6933	40.9503	41.0020	41.2629	41.2629	41.3155	41.1582	41.0020	40.8986	40.7957	
alpha	3.7061	3.7095	3.7129	3.7300	3.7335	3.7509	3.7509	3.7544	3.7439	3.7335	3.7266	3.7197	
util living area	0.8797	0.8307	0.7550	0.6410	0.5039	0.3638	0.2635	0.2915	0.4517	0.6763	0.8296	0.8932 (86)	
Living	20.2293	20.3947	20.5889	20.7641	20.8647	20.9058	20.9150	20.9138	20.8907	20.7598	20.4738	20.1823	
Non living	19.4346	19.6370	19.8711	20.0791	20.1911	20.2366	20.2447	20.2446	20.2215	20.0795	19.7409	19.3797	
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	20.6057	20.3947	20.5889	20.7641	20.8647	20.9058	20.9150	20.9138	20.8907	20.7598	20.4738	20.2967 (87)	
Th 2	20.3418	20.3426	20.3434	20.3473	20.3480	20.3519	20.3519	20.3527	20.3504	20.3480	20.3465	20.3449 (88)	
util rest of house	0.8681	0.8158	0.7352	0.6153	0.4729	0.3284	0.2252	0.2512	0.4127	0.6464	0.8122	0.8827 (89)	
MIT 2	19.9802	19.6370	19.8711	20.0791	20.1911	20.2366	20.2447	20.2446	20.2215	20.0795	19.7409	19.5536 (90)	
Living area fraction									FLA = Living area / (4) =			0.4205 (91)	
MIT	20.2432	19.9556	20.1729	20.3671	20.4743	20.5180	20.5266	20.5260	20.5029	20.3656	20.0491	19.8661 (92)	
Temperature adjustment												0.0000	
adjusted MIT	20.2432	19.9556	20.1729	20.3671	20.4743	20.5180	20.5266	20.5260	20.5029	20.3656	20.0491	19.8661 (93)	

8. Space heating requirement

Utilisation	0.8662	0.8064	0.7298	0.6161	0.4790	0.3375	0.2355	0.2620	0.4220	0.6473	0.8037	0.8742 (94)
Useful gains	616.1099	645.7041	639.7238	578.6945	466.8705	321.6471	215.2172	225.5198	344.1703	483.5649	555.1666	592.9345 (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	891.3589	840.6795	762.5168	635.4904	485.6465	325.4820	215.9549	226.6359	353.0475	540.5083	718.5253	871.4800 (97)
Space heating kWh	204.7853	131.0235	91.3580	40.8930	13.9694	0.0000	0.0000	0.0000	0.0000	42.3659	117.6183	207.2378 (98a)
Space heating requirement - total per year (kWh/year)												849.2511
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	204.7853	131.0235	91.3580	40.8930	13.9694	0.0000	0.0000	0.0000	0.0000	42.3659	117.6183	207.2378 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												849.2511
Space heating per m2										(98c) / (4) =		10.6156 (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 %)													400.0453 (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	204.7853	131.0235	91.3580	40.8930	13.9694	0.0000	0.0000	0.0000	0.0000	42.3659	117.6183	207.2378 (98)	
Space heating efficiency (main heating system 1)	400.0453	400.0453	400.0453	400.0453	400.0453	0.0000	0.0000	0.0000	0.0000	400.0453	400.0453	400.0453 (210)	
Space heating fuel (main heating system)	51.1905	32.7522	22.8369	10.2221	3.4919	0.0000	0.0000	0.0000	0.0000	10.5903	29.4012	51.8036 (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	232.8031	189.6145	160.2146	108.3899	74.3819	64.3633	62.7401	80.8900	113.4438	165.1131	206.9455	230.3265 (64)	
Efficiency of water heater (217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600 (216)	
Fuel for water heating, kWh/month	113.7512	92.6485	78.2833	52.9610	36.3442	31.4489	30.6558	39.5241	55.4304	80.6768	101.1167	112.5410 (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	18.6245	16.8222	18.6245	18.0237	18.6245	18.0237	18.6245	18.6245	18.0237	18.6245	18.0237	18.6245 (231)	
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.5900	-61.1449	-90.3236	-101.9137	-108.0874	-100.5251	-99.1500	-94.5157	-84.8795	-70.5134	-46.4241	-35.5298 (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	-17.9200	-40.8732	-89.4572	-145.8687	-202.5527	-206.3863	-203.0964	-166.8139	-115.2191	-61.6575	-24.7263	-13.8745 (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												212.2888 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												204.6600	

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Water heating fuel used	825.3817 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)	
mechanical ventilation fans (SFP = 0.5720)	139.2889 (230a)
pump for solar water heating	80.0000 (230g)
Total electricity for the above, kWh/year	219.2889 (231)
Electricity for lighting (calculated in Appendix L)	182.6625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2223.0433 (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	-783.4214 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	212.2888	16.4900	35.0064 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	825.3817	16.4900	136.1054 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	139.2889	16.4900	22.9687 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	182.6625	16.4900	30.1210 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-934.5973	16.4900	-154.1151
PV Unit electricity exported	-1288.4460	5.5900	-72.0241
Total			-226.1392 (252)
Total energy cost			11.2544 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.0324 (257)
SAP value		99.4746
SAP rating (Section 12)		99 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	212.2888	0.1570	33.3250 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	825.3817	0.1462	120.6641 (264)
Space and water heating			153.9891 (265)
Pumps, fans and electric keep-hot	219.2889	0.1387	30.4181 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-934.5973	0.1344	-125.6240
PV Unit electricity exported	-1288.4460	0.1238	-159.5508
Total			-285.1749 (269)
Total CO2, kg/year			-74.4038 (272)
CO2 emissions per m2			-0.9300 (273)
EI value			100.7976
EI rating			101 (274)
EI band			A

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

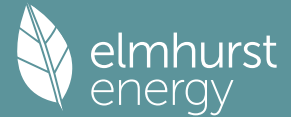
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	40.0000 (1b)	x 2.3700 (2b)	= 94.8000 (1b) - (3b)
First floor	40.0000 (1c)	x 2.6200 (2c)	= 104.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	199.6000 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)

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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 0 * 10 = 0.0000 (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) = 0.0000 / (5) = 0.0000 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 1.0000 (17)
 Infiltration rate 0.0500 (18)
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000 (22)
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250 (22a)
Adj infilt rate	0.0701	0.0659	0.0648	0.0595	0.0584	0.0499	0.0489	0.0478	0.0531	0.0616	0.0638	0.0691 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1651	0.1609	0.1598	0.1545	0.1534	0.1449	0.1439	0.1428	0.1481	0.1566	0.1587	0.1641 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			11.9700	1.1450	13.7061		(27)
Door			2.1200	1.0000	2.1200		(26a)
Floor 1 P/a 0.45			40.0000	0.1200	4.8000	110.0000	4400.0000 (28a)
External Wall 1 Render	89.9200	14.0900	75.8300	0.1500	11.3745	9.0000	682.4700 (29a)
External Roof 1 Horz	40.0000		40.0000	0.0900	3.6000	9.0000	360.0000 (30)
Total net area of external elements Aum(A, m2)			169.9200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.6006		(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000 (32)
Internal Wall 1 GF			34.1300			9.0000	307.1700 (32c)
Internal Wall 2 FF			60.2000			9.0000	541.8000 (32c)
Internal Floor 1			40.0000			18.0000	720.0000 (32d)
Internal Ceiling 1			40.0000			9.0000	360.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8169.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							102.1230 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	9.9800	0.0300	0.2994
E5 Ground floor (normal)	18.0000	0.0210	0.3780
E10 Eaves (insulation at ceiling level)	10.0000	0.0440	0.4400
E12 Gable (insulation at ceiling level)	8.0000	0.0510	0.4080
E6 Intermediate floor within a dwelling	18.0000	0.0800	1.4400
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E18 Party wall between dwellings	9.9800	0.0395	0.3942
E2 Other lintels (including other steel lintels)	10.6100	0.0840	0.8912
E3 Sill	9.6000	0.0430	0.4128
E4 Jamb	23.1000	0.0340	0.7854

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4810 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 46.0817 (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)m	10.8765	10.5965	10.5265	10.1766	10.1066	9.5467	9.4768	9.4068	9.7567	10.3166	10.4565	10.8065 (38)
Heat transfer coeff	56.9581	56.6782	56.6082	56.2583	56.1883	55.6284	55.5584	55.4884	55.8384	56.3982	56.5382	56.8881 (39)
Average = Sum(39)m / 12 =												56.2524

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.7120	0.7085	0.7076	0.7032	0.7024	0.6954	0.6945	0.6936	0.6980	0.7050	0.7067	0.7111 (40)
HLP (average)												0.7032
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

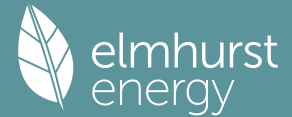
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4629 (42)

Hot water usage for mixer showers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	75.5424	74.4205	72.8406	69.9276	67.7463	65.3277	64.0212	65.5901	67.2982	69.8863	72.8593	75.2870 (42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522 (42c)
Average daily hot water use (litres/day)												106.2689 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.3945	112.8235	109.7944	105.4322	101.8018	97.9340	96.6275	99.6456	102.8029	106.8401	111.2623	115.1391 (44)
Energy conte	182.7567	160.6591	168.7499	144.3314	137.0448	120.4213	116.8626	123.3820	126.7662	144.9810	158.5135	180.2801 (45)
Energy content (annual)												Total = Sum(45)m = 1764.7487
Distribution loss (46)m = 0.15 x (45)m	27.4135	24.0989	25.3125	21.6497	20.5567	18.0632	17.5294	18.5073	19.0149	21.7472	23.7770	27.0420 (46)
Water storage loss:												250.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												

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Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (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	232.8031	205.8623	217.4006	186.0098	174.2969	156.2465	153.8821	161.3320	169.7954	193.6317	206.9455	230.3265 (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												760.2870 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												760.2870
Solar input	-9.5843	-27.8777	-72.6433	-95.7729	-112.5478	-111.8749	-100.3437	-97.4999	-74.4755	-44.6636	-13.0032	-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 (64a)
Output from w/h	223.2188	177.9846	144.7572	90.2369	61.7490	44.3716	53.5384	63.8320	95.3198	148.9680	193.9423	230.3265 (64)
												Total per year (kWh/year) = Sum(64)m = 1528.2453 (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	100.8037	89.5817	95.0299	81.3329	75.3691	68.7003	68.4724	71.3845	76.5731	87.1267	91.4513	99.9802 (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	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717	147.7717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8578	22.9666	18.6777	14.1402	10.5700	8.9236	9.6423	12.5334	16.8223	21.3598	24.9301	26.5764 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5232	330.9219	322.3573	304.1245	281.1088	259.4772	245.0260	241.6274	250.1919	268.4248	291.4405	313.0720 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400	52.2400 (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)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144 (71)
Water heating gains (Table 5)	135.4889	133.3061	127.7283	112.9624	101.3025	95.4171	92.0328	95.9469	106.3515	117.1058	127.0158	134.3821 (72)
Total internal gains	590.3671	588.6919	570.2606	532.7243	494.4785	465.3152	448.1984	451.6049	474.8630	508.3876	544.8836	575.5277 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast		4.4100	15.8649	0.7600	0.7000	0.7700	25.7941 (75)					
Southwest		7.5600	48.0626	0.7600	0.7000	0.7700	133.9596 (79)					
Solar gains	159.7537	241.9825	347.4510	476.3894	536.4903	595.5914	513.2000	483.6134	407.1773	281.5525	184.9883	131.6282 (83)
Total gains	750.1208	830.6744	917.7116	1009.1137	1030.9688	1060.9066	961.3984	935.2183	882.0402	789.9402	729.8719	707.1560 (84)

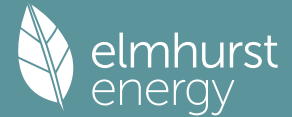
7. Mean internal temperature (heating season)

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	39.8433	40.0401	40.0896	40.3390	40.3892	40.7957	40.8471	40.8986	40.6423	40.2388	40.1392	39.8923
alpha	3.6562	3.6693	3.6726	3.6893	3.6926	3.7197	3.7231	3.7266	3.7095	3.6826	3.6759	3.6595
util living area	0.8086	0.7586	0.6887	0.5861	0.4718	0.3367	0.2757	0.2771	0.3850	0.5702	0.7272	0.8138 (86)
Living	20.4918	20.5905	20.6976	20.8053	20.8736	20.9073	20.9135	20.9136	20.9021	20.8393	20.6881	20.5009
Non living	19.7471	19.8659	19.9907	20.1160	20.1909	20.2306	20.2370	20.2379	20.2240	20.1554	19.9857	19.7604
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	20.7400	20.5905	20.6976	20.8053	20.8736	20.9073	20.9135	20.9136	20.9021	20.8393	20.6881	20.5707 (87)
Th 2	20.3303	20.3334	20.3341	20.3380	20.3388	20.3449	20.3457	20.3465	20.3426	20.3364	20.3349	20.3310 (88)
util rest of house	0.7900	0.7375	0.6646	0.5589	0.4406	0.3039	0.2387	0.2392	0.3462	0.5340	0.7002	0.7947 (89)
MIT 2	20.0978	19.8659	19.9907	20.1160	20.1909	20.2306	20.2370	20.2379	20.2240	20.1554	19.9857	19.8632 (90)
Living area fraction												FLA = Living area / (4) = 0.4205 (91)
MIT	20.3679	20.1706	20.2879	20.4058	20.4780	20.5152	20.5215	20.5220	20.5092	20.4430	20.2811	20.1607 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3679	20.1706	20.2879	20.4058	20.4780	20.5152	20.5215	20.5220	20.5092	20.4430	20.2811	20.1607 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.7911	0.7321	0.6629	0.5617	0.4473	0.3124	0.2487	0.2494	0.3561	0.5400	0.6979	0.7895 (94)

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Useful gains	593.3891	608.1651	608.3700	566.8405	461.1470	331.4671	239.0634	233.2636	314.0821	426.5533	509.3499	558.2660 (95)
Ext temp.	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000 (96)
Heat loss rate W	761.4077	729.4823	689.9365	607.9183	476.3618	334.6132	240.0936	234.2746	318.7897	453.6103	592.5799	714.5547 (97)
Space heating kWh	125.0059	81.5252	60.6854	29.5760	11.3198	0.0000	0.0000	0.0000	0.0000	20.1305	59.9256	116.2788 (98a)
Space heating requirement - total per year (kWh/year)												504.4471
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	125.0059	81.5252	60.6854	29.5760	11.3198	0.0000	0.0000	0.0000	0.0000	20.1305	59.9256	116.2788 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												504.4471
Space heating per m2												(98c) / (4) = 6.3056 (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 %)												400.2851 (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	125.0059	81.5252	60.6854	29.5760	11.3198	0.0000	0.0000	0.0000	0.0000	20.1305	59.9256	116.2788 (98)
Space heating efficiency (main heating system 1)	400.2851	400.2851	400.2851	400.2851	400.2851	0.0000	0.0000	0.0000	0.0000	400.2851	400.2851	400.2851 (210)
Space heating fuel (main heating system)	31.2292	20.3668	15.1606	7.3887	2.8279	0.0000	0.0000	0.0000	0.0000	5.0290	14.9707	29.0490 (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	223.2188	177.9846	144.7572	90.2369	61.7490	44.3716	53.5384	63.8320	95.3198	148.9680	193.9423	230.3265 (64)
Efficiency of water heater	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600 (216)
Fuel for water heating, kWh/month	109.0681	86.9660	70.7306	44.0911	30.1715	21.6807	26.1597	31.1893	46.5747	72.7881	94.7632	112.5410 (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	18.6245	16.8222	18.6245	18.0237	18.6245	18.0237	18.6245	18.6245	18.0237	18.6245	18.0237	18.6245 (231)
Lighting	22.6332	18.1572	16.3485	11.9776	9.2519	7.5588	8.4399	10.9704	14.2495	18.6961	21.1172	23.2622 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-52.8279	-67.9953	-97.8907	-109.5114	-112.2454	-106.3267	-102.2739	-100.5918	-92.9938	-79.1096	-56.3728	-44.3216 (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)	-28.5657	-52.2533	-111.1316	-184.5567	-236.3915	-269.1247	-231.8107	-211.1949	-150.9417	-81.5381	-36.9584	-21.1999 (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												126.0220 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												204.6600
Water heating fuel used												746.7240 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)												
mechanical ventilation fans (SFP = 0.5720)												139.2889 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												219.2889 (231)
Electricity for lighting (calculated in Appendix L)												182.6625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2638.1280 (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												-1363.4307 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	126.0220	25.1600	31.7071 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	746.7240	25.1600	187.8758 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	139.2889	25.1600	35.0451 (249)
Pump for solar water heating	80.0000	25.1600	20.1280 (249)
Energy for lighting	182.6625	25.1600	45.9579 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1022.4607	25.1600	-257.2511
PV Unit electricity exported	-1615.6673	5.8100	-93.8703
Total			-351.1214 (252)

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Total energy cost

-30.4075 (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	126.0220	0.1569	19.7780 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	746.7240	0.1474	110.0354 (264)
Space and water heating			129.8134 (265)
Pumps, fans and electric keep-hot	219.2889	0.1387	30.4181 (267)
Energy for lighting	182.6625	0.1443	26.3638 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1022.4607	0.1351	-138.1627
PV Unit electricity exported	-1615.6673	0.1247	-201.4799
Total			-339.6426 (269)
Total CO2, kg/year			-153.0472 (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	126.0220	1.5810	199.2378 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	746.7240	1.5452	1153.8083 (278)
Space and water heating			1353.0461 (279)
Pumps, fans and electric keep-hot	219.2889	1.5128	331.7402 (281)
Energy for lighting	182.6625	1.5338	280.1739 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1022.4607	1.4994	-1533.1092
PV Unit electricity exported	-1615.6673	0.4577	-739.5193
Total			-2272.6285 (283)
Total Primary energy kWh/year			-307.6684 (286)