

Full SAP Calculation Printout



Property Reference	KAIROS-7248-24		Issued on Date	18/03/2024	
Assessment Reference	SEC1 - ASHP ROI TF 0.15 TG	Prop Type Ref	DS		
Property	9, Park Hill, Falmouth, Cornwall, TR11 3QH				
SAP Rating	101 A	DER	-3.05	TER	19.36
Environmental	102 A	% DER < TER			115.75
CO ₂ Emissions (t/year)	-0.17	DFEE	36.14	TFEE	57.08
Compliance Check	See BREL	% DFEE < TFEE			36.68
% DPER < TPER	100.38	DPER	-0.39	TPER	102.80
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client					

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	26.0000 (1b)	2.3000 (2b)	59.8000 (1b) - (3b)
First floor	11.8900 (1c)	2.8100 (2c)	33.4100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	93.2100 (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												0.7500 (17)
Infiltration rate												0.0375 (18)
Number of sides sheltered												3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.0291 (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	0.0371	0.0363	0.0356	0.0320	0.0312	0.0276	0.0276	0.0269	0.0291	0.0312	0.0327	0.0341 (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) =												81.9000 (23c)
Effective ac	0.1276	0.1268	0.1261	0.1225	0.1217	0.1181	0.1181	0.1174	0.1196	0.1217	0.1232	0.1246 (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 = 0.79)			1.5600	0.7658	1.1946		(27)
Door			5.6700	0.7900	4.4793		(26a)
5			0.7800	1.0536	0.8218		(27a)
6			1.2000	1.0536	1.2644		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000 (28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700 (29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700 (29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400 (30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900 (30)
Total net area of external elements Aum(A, m ²)			121.0400				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.2981	(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000 (32)
Internal Wall 1 GF			43.4700			9.0000	391.2300 (32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800 (32c)

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Internal Floor 1	11.8900	18.0000	214.0200 (32d)
Internal Ceiling 1	11.8900	9.0000	107.0100 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 7323.0100 (34)
 List of Thermal Bridges 193.2703 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 5.1157 (36)
 Total fabric heat loss (33) + (36) + (36a) = 27.4138 (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	3.9235	3.9012	3.8788	3.7671	3.7447	3.6330	3.6330	3.6106	3.6777	3.7447	3.7894	3.8341 (38)
Average = Sum(39)m / 12 =	31.3373	31.3149	31.2926	31.1808	31.1585	31.0467	31.0467	31.0244	31.0914	31.1585	31.2032	31.2479 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8271	0.8265	0.8259	0.8229	0.8223	0.8194	0.8194	0.8188	0.8206	0.8223	0.8235	0.8247 (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 1.3515 (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	53.9672	53.1657	52.0371	49.9560	48.3977	46.6699	45.7366	46.8573	48.0776	49.9265	52.0504	53.7848 (42b)
Hot water usage for other uses	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702 (42c)
Average daily hot water use (litres/day)	31.3373	31.3149	31.2926	31.1808	31.1585	31.0467	31.0467	31.0244	31.0914	31.1585	31.2032	31.2479 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550 (44)
Energy content	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915 (45)
Energy content (annual)												Total = Sum(45)m = 1260.7304
Distribution loss (46)m = 0.15 x (45)m	19.5841	17.2161	18.0832	15.4665	14.6856	12.9043	12.5229	13.2216	13.5842	15.5361	16.9862	19.3187 (46)

Water storage loss:
 Store volume 170.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.2300 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 0.6642 (55)
 Total storage loss
 20.5902 18.5976 20.5902 19.9260 20.5902 19.9260 20.5902 20.5902 19.9260 20.5902 19.9260 20.5902 20.5902 (56)

If cylinder contains dedicated solar storage
 20.5902 18.5976 20.5902 19.9260 20.5902 19.9260 20.5902 20.5902 19.9260 20.5902 19.9260 20.5902 20.5902 (57)

Primary loss	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month
 174.4134 154.3831 164.4069 145.5479 141.7569 128.4665 127.3389 131.9963 132.9994 147.4265 155.6795 172.6441 (62)

WWHRS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
 174.4134 154.3831 164.4069 145.5479 141.7569 128.4665 127.3389 131.9963 132.9994 147.4265 155.6795 172.6441 (64)
 Total per year (kWh/year) = Sum(64)m = 1777.0594 (64)
 1777 (64)

12Total per year (kWh/year)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
 78.4935 69.8495 75.1664 68.2344 67.6353 62.5549 62.8413 64.3899 64.0621 69.5204 71.6032 77.9052 (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	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	69.0255	76.4211	69.0255	71.3263	69.0255	71.3263	69.0255	69.0255	71.3263	69.0255	71.3263	69.0255 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	116.2657	117.4722	114.4319	107.9596	99.7893	92.1105	86.9805	85.7740	88.8143	95.2867	103.4569	111.1358 (68)
Pumps, fans	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573 (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)	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582 (71)
Total internal gains	105.5021	103.9427	101.0301	94.7700	90.9076	86.8818	84.4641	86.5455	88.9751	93.4414	99.4489	104.7113 (72)
Total internal gains	334.0651	341.1078	327.7593	317.3277	302.9942	293.5904	283.7419	284.6168	292.3875	301.0254	317.5040	328.1444 (73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
Southwest			1.0800	36.7938	0.6800	0.7000	0.7700	13.1081 (79)				
Northwest			0.4800	11.2829	0.6800	0.7000	0.7700	1.7865 (81)				
Southwest			0.7800	26.0000	0.6800	0.7000	1.0000	8.6880 (82)				
Horizontal			1.2000	26.0000	0.6800	0.7000	1.0000	13.3661 (82)				
Solar gains	36.9486	71.7689	118.5321	175.8476	219.7224	227.1578	215.3215	181.8618	138.6093	85.1045	45.9400	30.4896 (83)
Total gains	371.0137	412.8767	446.2914	493.1754	522.7167	520.7482	499.0634	466.4786	430.9969	386.1299	363.4440	358.6340 (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	64.9121	64.9584	65.0048	65.2378	65.2846	65.5196	65.5196	65.5668	65.4254	65.2846	65.1911	65.0978
alpha	5.3275	5.3306	5.3337	5.3492	5.3523	5.3680	5.3680	5.3711	5.3617	5.3523	5.3461	5.3399
util living area	0.9475	0.9130	0.8490	0.7125	0.5436	0.3802	0.2735	0.3056	0.4917	0.7606	0.9066	0.9545 (86)
Living	20.4633	20.5875	20.7334	20.8699	20.9264	20.9403	20.9420	20.9418	20.9350	20.8574	20.6515	20.4329
Non living	19.6144	19.7653	19.9377	20.0906	20.1470	20.1613	20.1623	20.1628	20.1565	20.0818	19.8476	19.5790
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	20.7254	20.5875	20.7334	20.8699	20.9264	20.9403	20.9420	20.9418	20.9350	20.8574	20.6515	20.5123 (87)
Th 2	20.2299	20.2305	20.2310	20.2335	20.2340	20.2366	20.2366	20.2371	20.2355	20.2340	20.2330	20.2320 (88)
util rest of house	0.9376	0.8981	0.8257	0.6777	0.5019	0.3354	0.2262	0.2551	0.4395	0.7211	0.8883	0.9458 (89)
MIT 2	19.9845	19.7653	19.9377	20.0906	20.1470	20.1613	20.1623	20.1628	20.1565	20.0818	19.8476	19.6966 (90)
Living area fraction	0.3527	0.1739	0.3331	0.4779	0.5343	0.5484	0.5498	0.5499	0.5434	0.4673	0.2471	0.4970 (91)
MIT	20.3527	20.1739	20.3331	20.4779	20.5343	20.5484	20.5498	20.5499	20.5434	20.4673	20.2471	20.1020 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3527	20.1739	20.3331	20.4779	20.5343	20.5484	20.5498	20.5499	20.5434	20.4673	20.2471	20.1020 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9393	0.8969	0.8290	0.6891	0.5184	0.3538	0.2456	0.2758	0.4607	0.7336	0.8887	0.9442 (94)
Useful gains	348.5001	370.3235	369.9677	339.8545	270.9811	184.2215	122.5788	128.6565	198.5567	283.2569	322.9877	338.6069 (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	503.0491	478.3002	432.8737	361.0082	275.2638	184.6787	122.6282	128.7491	200.3335	307.4492	410.2311	496.9030 (97)
Space heating kWh	114.9845	72.5604	46.8021	15.2306	3.1863	0.0000	0.0000	0.0000	0.0000	17.9991	62.8152	117.7723 (98a)
Space heating requirement - total per year (kWh/year)												451.3505
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	114.9845	72.5604	46.8021	15.2306	3.1863	0.0000	0.0000	0.0000	0.0000	17.9991	62.8152	117.7723 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												451.3505
Space heating per m2												11.9121 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 %)												360.0933 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	114.9845	72.5604	46.8021	15.2306	3.1863	0.0000	0.0000	0.0000	0.0000	17.9991	62.8152	117.7723 (98)
Space heating efficiency (main heating system 1)	360.0933	360.0933	360.0933	360.0933	360.0933	0.0000	0.0000	0.0000	0.0000	360.0933	360.0933	360.0933 (210)
Space heating fuel (main heating system)	31.9319	20.1504	12.9972	4.2296	0.8849	0.0000	0.0000	0.0000	0.0000	4.9984	17.4442	32.7061 (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	174.4134	154.3831	164.4069	145.5479	141.7569	128.4665	127.3389	131.9963	132.9994	147.4265	155.6795	172.6441 (64)
Efficiency of water heater	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571 (216)
Fuel for water heating, kWh/month	88.2850	78.1461	83.2200	73.6738	71.7549	65.0275	64.4567	66.8142	67.3220	74.6248	78.8023	87.3895 (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	4.6746	4.2222	4.6746	4.5238	4.6746	4.5238	4.6746	4.6746	4.5238	4.6746	4.5238	4.6746 (231)
Lighting	13.3454	10.7062	9.6397	7.0625	5.4553	4.4570	4.9765	6.4686	8.4021	11.0240	12.4516	13.7163 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-37.4317	-52.8808	-75.8148	-83.1714	-88.1801	-81.8625	-80.9222	-77.5399	-69.7199	-59.4446	-40.9188	-32.2737 (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)												

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(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	-22.0783	-49.1373	-103.9660	-164.6110	-222.4599	-225.0490	-221.3242	-183.7897	-130.3787	-72.7263	-30.2316	-17.1306	(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													125.3427 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													197.5571
Water heating fuel used													899.5168 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.4840)													
mechanical ventilation fans (SFP = 0.4840)													55.0392 (230a)
Total electricity for the above, kWh/year													55.0392 (231)
Electricity for lighting (calculated in Appendix L)													107.7053 (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													-1035.4393 (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	125.3427	0.1578	19.7841 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	899.5168	0.1407	126.5806 (264)
Space and water heating			146.3647 (265)
Pumps, fans and electric keep-hot	55.0392	0.1387	7.6346 (267)
Energy for lighting	107.7053	0.1443	15.5452 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-780.1606	0.1349	-105.2152
PV Unit electricity exported	-1442.8827	0.1247	-179.9115
Total			-285.1268 (269)
Total CO2, kg/year			-115.5823 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-3.0500 (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	125.3427	1.5843	198.5774 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	899.5168	1.5203	1367.5578 (278)
Space and water heating			1566.1352 (279)
Pumps, fans and electric keep-hot	55.0392	1.5128	83.2633 (281)
Energy for lighting	107.7053	1.5338	165.2020 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-780.1606	1.4985	-1169.0340
PV Unit electricity exported	-1442.8827	0.4577	-660.3435
Total			-1829.3775 (283)
Total Primary energy kWh/year			-14.7770 (286)
Dwelling Primary energy Rate (DPER)			-0.3900 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 93.2109 (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)

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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 2 * 10 = 20.0000 (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) = 20.0000 / (5) = 0.2146 (8)
 Pressure test Yes
 Pressure Test Method Blower Door
 Measured/design AP50 5.0000 (17)
 Infiltration rate 0.4646 (18)
 Number of sides sheltered 3 (19)
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3600 (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
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
Adj infilt rate												
Effective ac	0.4591	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230
	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895

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			5.6700	1.0000	5.6700		(26a)
TER Opening Type (Uw = 1.20)			1.5600	1.1450	1.7863		(27)
5			0.7800	1.5918	1.2416		(27a)
6			1.2000	2.0221	2.4265		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800		(28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1800	5.7834		(29a)
External Wall 2 First Floor	28.5300		28.5300	0.1800	5.1354		(29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1100	1.3486		(30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1100	1.4201		(30)
Total net area of external elements Aum(A, m2)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					28.1918		(33)
Party Wall 1			16.0900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.2703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0900	1.0683
E5 Ground floor (normal)	17.1100	0.1600	2.7376
E11 Eaves (insulation at rafter level)	8.2000	0.0400	0.3280
E6 Intermediate floor within a dwelling	4.1000	0.0000	0.0000
E18 Party wall between dwellings	9.5700	0.0600	0.5742
R4 Ridge (vaulted ceiling)	4.1000	0.0800	0.3280
E13 Gable (insulation at rafter level)	3.1800	0.0800	0.2544
E14 Flat roof	13.0100	0.0800	1.0408
E15 Flat roof with parapet	7.0000	0.5600	3.9200
P1 Party wall - Ground floor	3.4500	0.0800	0.2760
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0500	0.2400
E3 Sill	2.1000	0.0500	0.1050
E4 Jamb	15.8000	0.0500	0.7900
R1 Head of roof window	0.6600	0.0800	0.0528
R2 Sill of roof window	0.6600	0.0600	0.0396
R3 Jamb of roof window	2.3600	0.0800	0.1888

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.9435 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 40.1353 (37)

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

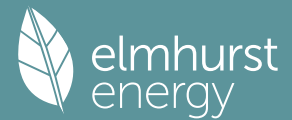
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.6207	18.4949	18.3715	17.7921	17.6837	17.1791	17.1791	17.0856	17.3735	17.6837	17.9030	18.1323
Average = Sum(39)m / 12 =	58.7560	58.6302	58.5068	57.9274	57.8190	57.3144	57.3144	57.2209	57.5088	57.8190	58.0383	58.2676

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5507	1.5474	1.5441	1.5288	1.5260	1.5127	1.5127	1.5102	1.5178	1.5260	1.5318	1.5378
HLP (average)												1.5288
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers												
Hot water usage for baths												
Hot water usage for other uses												
Average daily hot water use (litres/day)												
Daily hot water use	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550
Energy conte	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:												
Store volume												170.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.5003
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												0.8102

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Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(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	178.9385	158.4703	168.9320	149.9270	146.2820	132.8457	131.8640	136.5214	137.3785	151.9516	160.0586	177.1692	(62)
WWHS	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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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)
FGHS	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	178.9385	158.4703	168.9320	149.9270	146.2820	132.8457	131.8640	136.5214	137.3785	151.9516	160.0586	177.1692	(64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											1830.3388	(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	82.1136	73.1192	78.7865	71.7377	71.2553	66.0582	66.4613	68.0099	67.5654	73.1405	75.1065	81.5253	(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	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	67.1374	74.3307	67.1374	69.3753	67.1374	69.3753	67.1374	67.1374	69.3753	67.1374	69.3753	67.1374	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.2657	117.4722	114.4319	107.9596	99.7893	92.1105	86.9805	85.7740	88.8143	95.2867	103.4569	111.1358	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	(71)
Water heating gains (Table 5)	110.3678	108.8084	105.8958	99.6357	95.7733	91.7475	89.3298	91.4112	93.8408	98.3071	104.3146	109.5770	(72)
Total internal gains	340.0427	346.8831	333.7369	323.2424	308.9718	296.5050	286.7195	287.5944	295.3022	307.0030	323.4186	334.1220	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Southwest	1.0800	36.7938	0.6300	0.7000	0.7700	12.1442	(79)						
Northwest	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(81)						
Southwest	0.7800	26.0000	0.6300	0.7000	1.0000	8.0491	(82)						
Horizontal	1.2000	26.0000	0.6300	0.7000	1.0000	12.3833	(82)						
Solar gains	34.2318	66.4918	109.8165	162.9177	203.5664	210.4550	199.4891	168.4896	128.4175	78.8468	42.5621	28.2477	(83)
Total gains	374.2745	413.3749	443.5534	486.1601	512.5382	506.9601	486.2085	456.0840	423.7196	385.8498	365.9807	362.3697	(84)

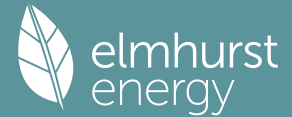
7. Mean internal temperature (heating season)

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	34.6206	34.6949	34.7681	35.1158	35.1817	35.4914	35.4914	35.5494	35.3715	35.1817	35.0487	34.9108		
alpha	3.3080	3.3130	3.3179	3.3411	3.3454	3.3661	3.3661	3.3700	3.3581	3.3454	3.3366	3.3274		
util living area	0.9741	0.9625	0.9409	0.8866	0.7880	0.6346	0.4896	0.5350	0.7446	0.9050	0.9596	0.9766	(86)	
MIT	19.0477	19.2699	19.6336	20.1417	20.5741	20.8561	20.9549	20.9387	20.7409	20.1977	19.5521	19.0160	(87)	
Th 2	19.6497	19.6522	19.6546	19.6659	19.6681	19.6780	19.6780	19.6799	19.6742	19.6681	19.6638	19.6593	(88)	
util rest of house	0.9674	0.9528	0.9250	0.8548	0.7273	0.5327	0.3551	0.3991	0.6540	0.8714	0.9474	0.9705	(89)	
MIT 2	17.4566	17.7371	18.1927	18.8169	19.3089	19.5920	19.6627	19.6567	19.4964	18.9001	18.1040	17.4227	(90)	
Living area fraction	18.2473	18.4989	18.9088	19.4752	19.9377	20.2202	20.3049	20.2938	20.1149	19.5450	18.8237	18.2145	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.2473	18.4989	18.9088	19.4752	19.9377	20.2202	20.3049	20.2938	20.1149	19.5450	18.8237	18.2145	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9579	0.9419	0.9139	0.8495	0.7409	0.5770	0.4212	0.4652	0.6871	0.8676	0.9374	0.9616	(94)	
Useful gains	358.5194	389.3771	405.3552	412.9848	379.7280	292.5129	204.7833	212.1487	291.1564	334.7787	343.0635	348.4561	(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	819.4876	797.3047	725.9979	612.5969	476.2939	322.1195	212.3431	222.8076	345.9079	517.1884	680.4233	816.5916	(97)	
Space heating kWh	342.9604	274.1273	238.5581	143.7207	71.8450	0.0000	0.0000	0.0000	0.0000	135.7128	242.8990	348.2928	(98a)	
Space heating requirement - total per year (kWh/year)												1798.1162		
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	342.9604	274.1273	238.5581	143.7207	71.8450	0.0000	0.0000	0.0000	0.0000	135.7128	242.8990	348.2928	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1798.1162		
Space heating per m2												(98c) / (4) =	47.4562	(99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 1)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	342.9604	274.1273	238.5581	143.7207	71.8450	0.0000	0.0000	0.0000	0.0000	135.7128	242.8990	348.2928	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	371.5713	296.9960	258.4595	155.7104	77.8386	0.0000	0.0000	0.0000	0.0000	147.0345	263.1626	377.3487	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	178.9385	158.4703	168.9320	149.9270	146.2820	132.8457	131.8640	136.5214	137.3785	151.9516	160.0586	177.1692	(64)
Efficiency of water heater (217)m	85.4941	85.2768	84.8335	83.9651	82.5559	79.8000	79.8000	79.8000	79.8000	83.8072	84.9925	85.5469	(216)
Fuel for water heating, kWh/month	209.2993	185.8304	199.1335	178.5588	177.1915	166.4733	165.2431	171.0794	172.1535	181.3109	188.3209	207.1017	(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	7.3041	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	13.9498	11.1911	10.0763	7.3823	5.7023	4.6589	5.2019	6.7616	8.7826	11.5233	13.0155	14.3375	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-23.4378	-32.5868	-46.2305	-51.3381	-54.9116	-51.2013	-50.6794	-48.1315	-43.4567	-37.0906	-25.6525	-20.3274	(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	-14.6313	-30.6204	-60.5357	-90.4147	-119.0114	-119.2893	-117.7717	-99.8548	-73.4545	-43.4750	-19.4408	-11.5715	(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													1948.1215 (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													2201.6962 (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)													112.5830 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1285.1151 (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													3063.2856 (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	1948.1215	0.2100	409.1055	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2201.6962	0.2100	462.3562	(264)
Space and water heating			871.4617	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	112.5830	0.1443	16.2492	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-485.0442	0.1348	-65.3904	
PV Unit electricity exported	-800.0709	0.1261	-100.8760	
Total			-166.2665	(269)
Total CO2, kg/year			733.3737	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			19.3600	(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	1948.1215	1.1300	2201.3773	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2201.6962	1.1300	2487.9167	(278)
Space and water heating			4689.2941	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	112.5830	1.5338	172.6836	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-485.0442	1.4983	-726.7220	
PV Unit electricity exported	-800.0709	0.4628	-370.2929	
Total			-1097.0150	(283)
Total Primary energy kWh/year			3895.0635	(286)
Target Primary Energy Rate (TPER)			102.8000	(287)

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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	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4100 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 93.2100 (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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.2146	(8)										
Pressure test	Yes												
Pressure Test Method	Blower Door												
Measured/design AP50	0.7500		(17)										
Infiltration rate	0.2521		(18)										
Number of sides sheltered	3		(19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1954	(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	0.2491	0.2442	0.2393	0.2149	0.2100	0.1856	0.1856	0.1807	0.1954	0.2100	0.2198	0.2295	(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	0.5310	0.5298	0.5286	0.5231	0.5221	0.5172	0.5172	0.5163	0.5191	0.5221	0.5241	0.5263	(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 = 0.79)			1.5600	0.7658	1.1946		(27)
Door			5.6700	0.7900	4.4793		(26a)
5			0.7800	1.0536	0.8218		(27a)
6			1.2000	1.0536	1.2644		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000 (28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700 (29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700 (29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400 (30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900 (30)
Total net area of external elements Aum(A, m2)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2981		(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000 (32)
Internal Wall 1 GF			43.4700			9.0000	391.2300 (32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800 (32c)
Internal Floor 1			11.8900			18.0000	214.0200 (32d)
Internal Ceiling 1			11.8900			9.0000	107.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7323.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.2703 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360

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Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 5.1157 (36)
 Total fabric heat loss (33) + (36) + (36a) = 27.4138 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(39)m	16.3339	16.2969	16.2606	16.0900	16.0581	15.9095	15.9095	15.8820	15.9667	16.0581	16.1226	16.1901 (38)
Heat transfer coeff	43.7477	43.7106	43.6743	43.5037	43.4718	43.3233	43.3233	43.2957	43.3805	43.4718	43.5364	43.6039 (39)
Average = Sum(39)m / 12 =												43.5036
HLP	1.1546	1.1536	1.1527	1.1482	1.1473	1.1434	1.1434	1.1427	1.1449	1.1473	1.1490	1.1508 (40)
HLP (average)												1.1482
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												1.3515 (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	20.2827	19.9814	19.5573	18.7751	18.1895	17.5401	17.1893	17.6105	18.0692	18.7640	19.5623	20.2141 (42b)
Hot water usage for other uses	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702 (42c)
Average daily hot water use (litres/day)												44.6873 (43)
Daily hot water use	48.7529	47.4164	45.9569	44.1395	42.5186	40.8339	40.4832	41.9397	43.4336	45.1637	46.9972	48.6843 (44)
Energy conte	77.2127	67.5203	70.6341	60.4248	57.2382	50.2101	48.9609	51.9301	53.5579	61.2867	66.9562	76.2279 (45)
Energy content (annual)												Total = Sum(45)m = 742.1599
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												
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 (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	65.6308	57.3923	60.0390	51.3611	48.6525	42.6786	41.6167	44.1405	45.5242	52.0937	56.9128	64.7937 (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	65.6308	57.3923	60.0390	51.3611	48.6525	42.6786	41.6167	44.1405	45.5242	52.0937	56.9128	64.7937 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 630.8359 (64)
Electric shower(s)	37.5421	33.4504	36.5265	34.8568	35.5109	33.8739	35.0031	35.5109	34.8568	36.5265	35.8397	37.5421 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												427.0396 (64a)
Heat gains from water heating, kWh/month	25.7932	22.7107	24.1414	21.5545	21.0408	19.1381	19.1549	19.9129	20.0953	22.1551	23.1881	25.5840 (65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts												
(66)m	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	69.0255	76.4211	69.0255	71.3263	69.0255	71.3263	69.0255	69.0255	71.3263	69.0255	71.3263	69.0255 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.2657	117.4722	114.4319	107.9596	99.7893	92.1105	86.9805	85.7740	88.8143	95.2867	103.4569	111.1358 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573 (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)	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582 (71)
Water heating gains (Table 5)	34.6683	33.7956	32.4481	29.9368	28.2807	26.5807	25.7459	26.7646	27.9101	29.7783	32.2057	34.3871 (72)
Total internal gains	263.2314	270.9607	259.1773	252.4945	240.3673	233.2893	225.0237	224.8359	231.3225	237.3623	250.2608	257.8201 (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						
Southwest	1.0800	36.7938	0.6800	0.7000	0.7700	13.1081 (79)						
Northwest	0.4800	11.2829	0.6800	0.7000	0.7700	1.7865 (81)						
Southwest	0.7800	26.0000	0.6800	0.7000	1.0000	8.6880 (82)						
Horizontal	1.2000	26.0000	0.6800	0.7000	1.0000	13.3661 (82)						
Solar gains	36.9486	71.7689	118.5321	175.8476	219.7224	227.1578	215.3215	181.8618	138.6093	85.1045	45.9400	30.4896 (83)
Total gains	300.1800	342.7296	377.7094	428.3421	460.0897	460.4471	440.3452	406.6977	369.9319	322.4668	296.2008	288.3097 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	46.4978	46.5372	46.5759	46.7585	46.7928	46.9533	46.9533	46.9831	46.8914	46.7928	46.7234	46.6511
alpha	4.0999	4.1025	4.1051	4.1172	4.1195	4.1302	4.1302	4.1322	4.1261	4.1195	4.1149	4.1101

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util living area	0.9845	0.9725	0.9479	0.8777	0.7495	0.5703	0.4251	0.4763	0.7118	0.9134	0.9723	0.9868 (86)
MIT	19.5016	19.7239	20.0516	20.4811	20.7949	20.9494	20.9881	20.9812	20.8757	20.4564	19.9063	19.4556 (87)
Th 2	19.9565	19.9573	19.9581	19.9617	19.9624	19.9656	19.9656	19.9661	19.9643	19.9624	19.9610	19.9596 (88)
util rest of house												
	0.9806	0.9658	0.9350	0.8484	0.6947	0.4895	0.3288	0.3753	0.6340	0.8857	0.9643	0.9835 (89)
MIT 2	18.6113	18.8303	19.1497	19.5553	19.8260	19.9412	19.9620	19.9601	19.8958	19.5436	19.0152	18.5682 (90)
Living area fraction									FLA = Living area / (4) =			0.4970 (91)
MIT	19.0537	19.2744	19.5979	20.0154	20.3075	20.4422	20.4719	20.4675	20.3828	19.9972	19.4580	19.0092 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0537	19.2744	19.5979	20.0154	20.3075	20.4422	20.4719	20.4675	20.3828	19.9972	19.4580	19.0092 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9763	0.9604	0.9297	0.8501	0.7140	0.5278	0.3765	0.4252	0.6673	0.8868	0.9595	0.9795 (94)
Useful gains	293.0774	329.1525	351.1729	364.1224	328.5089	243.0097	165.8030	172.9195	246.8386	285.9523	284.2156	282.4109 (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	645.4422	628.3132	572.0429	483.5614	374.1836	253.1043	167.7452	176.1055	272.5502	408.5151	538.0240	645.7382 (97)
Space heating kWh	262.1594	201.0360	164.3273	85.9961	33.9820	0.0000	0.0000	0.0000	0.0000	91.1867	182.7421	270.3155 (98a)
Space heating requirement - total per year (kWh/year)												1291.7450
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	262.1594	201.0360	164.3273	85.9961	33.9820	0.0000	0.0000	0.0000	0.0000	91.1867	182.7421	270.3155 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.7450
Space heating per m2										(98c) / (4) =		34.0920 (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	407.2386	320.5921	329.0476	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8640	0.9182	0.8926	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	351.8602	294.3673	293.7143	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	478.4552	458.1909	424.8394	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	91.1484	121.8847	97.5571	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	22.7871	30.4712	24.3893	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												77.6476 (107)
Energy for space heating												34.0920 (99)
Energy for space cooling												2.0493 (108)
Total												36.1413 (109)
Fabric Energy Efficiency (DFEE)												36.1 (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	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	93.2109 (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	2 * 10 = 20.0000 (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) =	20.0000 / (5) = 0.2146 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4646 (18)
Number of sides sheltered	3 (19)

Full SAP Calculation Printout



Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3600 (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	0.4591	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230 (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	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895 (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			5.6700	1.0000	5.6700		(26a)
TER Opening Type (Uw = 1.20)			1.5600	1.1450	1.7863		(27)
5			0.7800	1.5918	1.2416		(27a)
6			1.2000	2.0221	2.4265		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800		(28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1800	5.7834		(29a)
External Wall 2 First Floor	28.5300		28.5300	0.1800	5.1354		(29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1100	1.3486		(30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1100	1.4201		(30)
Total net area of external elements Aum(A, m2)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 28.1918		(33)
Party Wall 1			16.0900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.2703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0900	1.0683
E5 Ground floor (normal)	17.1100	0.1600	2.7376
E11 Eaves (insulation at rafter level)	8.2000	0.0400	0.3280
E6 Intermediate floor within a dwelling	4.1000	0.0000	0.0000
E18 Party wall between dwellings	9.5700	0.0600	0.5742
R4 Ridge (vaulted ceiling)	4.1000	0.0800	0.3280
E13 Gable (insulation at rafter level)	3.1800	0.0800	0.2544
E14 Flat roof	13.0100	0.0800	1.0408
E15 Flat roof with parapet	7.0000	0.5600	3.9200
P1 Party wall - Ground floor	3.4500	0.0800	0.2760
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0500	0.2400
E3 Sill	2.1000	0.0500	0.1050
E4 Jamb	15.8000	0.0500	0.7900
R1 Head of roof window	0.6600	0.0800	0.0528
R2 Sill of roof window	0.6600	0.0600	0.0396
R3 Jamb of roof window	2.3600	0.0800	0.1888

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.9435 (36)

Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 40.1353 (37)

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

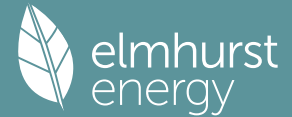
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.6207	18.4949	18.3715	17.7921	17.6837	17.1791	17.1791	17.0856	17.3735	17.6837	17.9030	18.1323 (38)
Average = Sum(39)m / 12 =	58.7560	58.6302	58.5068	57.9274	57.8190	57.3144	57.3144	57.2209	57.5088	57.8190	58.0383	58.2676 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5507	1.5474	1.5441	1.5288	1.5260	1.5127	1.5127	1.5102	1.5178	1.5260	1.5318	1.5378 (40)
HLP (average)												1.5288
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3515 (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	20.2827	19.9814	19.5573	18.7751	18.1895	17.5401	17.1893	17.6105	18.0692	18.7640	19.5623	20.2141	(42b)
Hot water usage for other uses	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702	(42c)
Average daily hot water use (litres/day)													44.6873 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	48.7529	47.4164	45.9569	44.1395	42.5186	40.8339	40.4832	41.9397	43.4336	45.1637	46.9972	48.6843	(44)
Energy content (annual)	77.2127	67.5203	70.6341	60.4248	57.2382	50.2101	48.9609	51.9301	53.5579	61.2867	66.9562	76.2279	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 742.1599
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	65.6308	57.3923	60.0390	51.3611	48.6525	42.6786	41.6167	44.1405	45.5242	52.0937	56.9128	64.7937	(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	65.6308	57.3923	60.0390	51.3611	48.6525	42.6786	41.6167	44.1405	45.5242	52.0937	56.9128	64.7937	(64)
12Total per year (kWh/year)													Total per year (kWh/year) = Sum(64)m = 630.8359 (64)
Electric shower(s)													631 (64)

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	37.5421	33.4504	36.5265	34.8568	35.5109	33.8739	35.0031	35.5109	34.8568	36.5265	35.8397	37.5421 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 427.0396 (64a)											
Heat gains from water heating, kWh/month	25.7932	22.7107	24.1414	21.5545	21.0408	19.1381	19.1549	19.9129	20.0953	22.1551	23.1881	25.5840 (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
	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727	67.5727 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	67.1374	74.3307	67.1374	69.3753	67.1374	69.3753	67.1374	67.1374	69.3753	67.1374	69.3753	67.1374 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	116.2657	117.4722	114.4319	107.9596	99.7893	92.1105	86.9805	85.7740	88.8143	95.2867	103.4569	111.1358 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573	29.7573 (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)												
	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582 (71)
Water heating gains (Table 5)												
	34.6683	33.7956	32.4481	29.9368	28.2807	26.5807	25.7459	26.7646	27.9101	29.7783	32.2057	34.3871 (72)
Total internal gains												
	261.3433	268.8703	257.2892	250.5434	238.4792	231.3383	223.1356	222.9478	229.3715	235.4742	248.3097	255.9320 (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					
Southwest		1.0800	36.7938	0.6300	0.7000	0.7700	12.1442 (79)					
Northwest		0.4800	11.2829	0.6300	0.7000	0.7700	1.6551 (81)					
Southwest		0.7800	26.0000	0.6300	0.7000	1.0000	8.0491 (82)					
Horizontal		1.2000	26.0000	0.6300	0.7000	1.0000	12.3833 (82)					
Solar gains	34.2318	66.4918	109.8165	162.9177	203.5664	210.4550	199.4891	168.4896	128.4175	78.8468	42.5621	28.2477 (83)
Total gains	295.5751	335.3621	367.1057	413.4611	442.0456	441.7933	422.6247	391.4374	357.7890	314.3210	290.8718	284.1797 (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	34.6206	34.6949	34.7681	35.1158	35.1817	35.4914	35.4914	35.5494	35.3715	35.1817	35.0487	34.9108
util living area	3.3080	3.3130	3.3179	3.3411	3.3454	3.3661	3.3661	3.3700	3.3581	3.3454	3.3366	3.3274
	0.9867	0.9788	0.9638	0.9218	0.8388	0.6948	0.5494	0.6022	0.8087	0.9421	0.9785	0.9884 (86)
MIT	18.8168	19.0494	19.4322	19.9830	20.4689	20.8090	20.9362	20.9122	20.6574	20.0288	19.3405	18.7842 (87)
Th 2	19.6497	19.6522	19.6546	19.6659	19.6681	19.6780	19.6780	19.6799	19.6742	19.6681	19.6638	19.6593 (88)
util rest of house	0.9831	0.9730	0.9532	0.8974	0.7855	0.5930	0.4043	0.4576	0.7265	0.9189	0.9715	0.9852 (89)
MIT 2	17.7142	17.9457	18.3240	18.8626	19.3070	19.5853	19.6603	19.6526	19.4810	18.9188	18.2443	17.6886 (90)
Living area fraction	18.2622	18.4942	18.8747	19.4194	19.8844	20.1934	20.2944	20.2786	20.0656	19.4704	18.7891	18.2331 (92)
MIT	18.2622	18.4942	18.8747	19.4194	19.8844	20.1934	20.2944	20.2786	20.0656	19.4704	18.7891	18.2331 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2622	18.4942	18.8747	19.4194	19.8844	20.1934	20.2944	20.2786	20.0656	19.4704	18.7891	18.2331 (93)

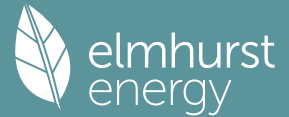
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9779	0.9663	0.9453	0.8920	0.7954	0.6359	0.4753	0.5274	0.7541	0.9146	0.9653	0.9804 (94)
Ext temp.	289.0371	324.0559	347.0260	368.7888	351.5902	280.9208	200.8942	206.4390	269.8108	287.4708	280.7669	278.6153 (95)
Heat loss rate W	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)
Space heating kWh	820.3615	797.0320	724.0066	609.3612	473.2144	320.5832	211.7423	221.9365	343.0767	512.8791	678.4154	817.6728 (97)
Space heating requirement - total per year (kWh/year)	395.3053	317.8399	280.4736	173.2121	90.4884	0.0000	0.0000	0.0000	0.0000	167.7038	286.3069	401.0588 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating requirement after solar contribution - total per year (kWh/year)	395.3053	317.8399	280.4736	173.2121	90.4884	0.0000	0.0000	0.0000	0.0000	167.7038	286.3069	401.0588 (98c)
Space heating per m2												55.7506 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7075	0.7862	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	381.1795	333.4413	325.5342	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	460.8733	441.4971	410.6308	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	57.3796	80.3935	63.3119	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction												1.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	14.3449	20.0984	15.8280	0.0000	0.0000	0.0000	0.0000 (106)

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Space cooling requirement	50.2712 (107)
Energy for space heating	55.7506 (99)
Energy for space cooling	1.3268 (108)
Total	57.0773 (109)
Fabric Energy Efficiency (TFEE)	57.1 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 93.2109 (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		0.7500 (17)
Infiltration rate		0.0375 (18)
Number of sides sheltered		3 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0291 (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	0.0371	0.0363	0.0356	0.0320	0.0312	0.0276	0.0276	0.0269	0.0291	0.0312	0.0327	0.0341 (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) =												81.9000 (23c)
Effective ac	0.1276	0.1268	0.1261	0.1225	0.1217	0.1181	0.1181	0.1174	0.1196	0.1217	0.1232	0.1246 (25)

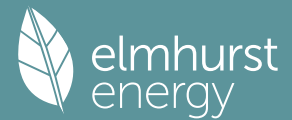
3. Heat losses and heat loss parameter

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 = 0.79)			1.5600	0.7658	1.1946		(27)
Door			5.6700	0.7900	4.4793		(26a)
5			0.7800	1.0536	0.8218		(27a)
6			1.2000	1.0536	1.2644		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000 (28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700 (29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700 (29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400 (30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900 (30)
Total net area of external elements Aum(A, m ²)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2981		(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000 (32)
Internal Wall 1 GF			43.4700			9.0000	391.2300 (32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800 (32c)
Internal Floor 1			11.8900			18.0000	214.0200 (32d)
Internal Ceiling 1			11.8900			9.0000	107.0100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7323.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.2703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000

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P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 5.1157 (36)
 Total fabric heat loss (33) + (36) + (36a) = 27.4138 (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
	3.9235	3.9012	3.8788	3.7671	3.7447	3.6330	3.6330	3.6106	3.6777	3.7447	3.7894	3.8341
Heat transfer coeff	31.3373	31.3149	31.2926	31.1808	31.1585	31.0467	31.0467	31.0244	31.0914	31.1585	31.2032	31.2479
Average = Sum(39)m / 12 =												31.1753

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8271	0.8265	0.8259	0.8229	0.8223	0.8194	0.8194	0.8188	0.8206	0.8223	0.8235	0.8247
HLP (average)												0.8228
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3515 (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 53.9672 53.1657 52.0371 49.9560 48.3977 46.6699 45.7366 46.8573 48.0776 49.9265 52.0504 53.7848 (42b)

Hot water usage for other uses 28.4702 27.4350 26.3997 25.3644 24.3291 23.2938 23.2938 24.3291 25.3644 26.3997 27.4350 28.4702 (42c)

Average daily hot water use (litres/day) 75.9181 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550
Energy conte	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915
Energy content (annual)										Total = Sum(45)m =		1260.7304
Distribution loss (46)m = 0.15 x (45)m	19.5841	17.2161	18.0832	15.4665	14.6856	12.9043	12.5229	13.2216	13.5842	15.5361	16.9862	19.3187
Water storage loss:												170.0000
Store volume												1.2300
a) If manufacturer declared loss factor is known (kWh/day):												0.5400
Temperature factor from Table 2b												0.6642
Enter (49) or (54) in (55)												
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624
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
Total heat required for water heating calculated for each month	174.4134	154.3831	164.4069	145.5479	141.7569	128.4665	127.3389	131.9963	132.9994	147.4265	155.6795	172.6441
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
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
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
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
Output from w/h	174.4134	154.3831	164.4069	145.5479	141.7569	128.4665	127.3389	131.9963	132.9994	147.4265	155.6795	172.6441
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
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000
Heat gains from water heating, kWh/month	78.4935	69.8495	75.1664	68.2344	67.6353	62.5549	62.8413	64.3899	64.0621	69.5204	71.6032	77.9052

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
	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2468	13.5421	11.0132	8.3377	6.2325	5.2617	5.6855	7.3902	9.9191	12.5946	14.6998	15.6706
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.5310	175.3317	170.7939	161.1337	148.9393	137.4783	129.8216	128.0209	132.5587	142.2190	154.4133	165.8743
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602
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
Losses e.g. evaporation (negative values) (Table 5)	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582
Water heating gains (Table 5)	105.5021	103.9427	101.0301	94.7700	90.9076	86.8818	84.4641	86.5455	88.9751	93.4414	99.4489	104.7113
Total internal gains	365.7691	364.3057	354.3265	335.7306	317.5687	301.1111	291.4605	293.4459	302.9422	319.7443	340.0513	357.7455

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
Southwest	1.0800	36.7938	0.6800	0.7000	0.7700	13.1081
Northwest	0.4800	11.2829	0.6800	0.7000	0.7700	1.7865
Southwest	0.7800	26.0000	0.6800	0.7000	1.0000	8.6880
Horizontal	1.2000	26.0000	0.6800	0.7000	1.0000	13.3661

Solar gains	36.9486	71.7689	118.5321	175.8476	219.7224	227.1578	215.3215	181.8618	138.6093	85.1045	45.9400	30.4896
Total gains	402.7177	436.0746	472.8585	511.5783	537.2911	528.2689	506.7820	475.3078	441.5515	404.8487	385.9913	388.2351

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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	64.9121	64.9584	65.0048	65.2378	65.2846	65.5196	65.5196	65.5668	65.4254	65.2846	65.1911	65.0978
alpha	5.3275	5.3306	5.3337	5.3492	5.3523	5.3680	5.3680	5.3711	5.3617	5.3523	5.3461	5.3399
util living area	0.9295	0.8963	0.8242	0.6931	0.5300	0.3749	0.2694	0.2999	0.4806	0.7363	0.8871	0.9390 (86)
Living	20.5267	20.6262	20.7636	20.8787	20.9281	20.9404	20.9420	20.9418	20.9357	20.8697	20.6875	20.4949
Non living	19.6912	19.8108	19.9713	20.0994	20.1484	20.1613	20.1623	20.1628	20.1570	20.0938	19.8891	19.6544
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	20.7579	20.6262	20.7636	20.8787	20.9281	20.9404	20.9420	20.9418	20.9357	20.8697	20.6875	20.5655 (87)
Th 2	20.2299	20.2305	20.2310	20.2335	20.2340	20.2366	20.2366	20.2371	20.2355	20.2340	20.2330	20.2320 (88)
util rest of house	0.9172	0.8796	0.7992	0.6581	0.4890	0.3307	0.2227	0.2503	0.4293	0.6960	0.8665	0.9280 (89)
MIT 2	20.0152	19.8108	19.9713	20.0994	20.1484	20.1613	20.1623	20.1628	20.1570	20.0938	19.8891	19.7585 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	20.3843	20.2160	20.3650	20.4867	20.5359	20.5485	20.5498	20.5500	20.5440	20.4794	20.2859	20.1596 (92)
Temperature adjustment	0.0000											
adjusted MIT	20.3843	20.2160	20.3650	20.4867	20.5359	20.5485	20.5498	20.5500	20.5440	20.4794	20.2859	20.1596 (93)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9198	0.8792	0.8038	0.6700	0.5053	0.3488	0.2419	0.2707	0.4501	0.7094	0.8680	0.9269 (94)
Useful gains	370.4198	383.4050	380.0673	342.7323	271.5124	184.2553	122.5829	128.6657	198.7608	287.1822	335.0519	359.8479 (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	504.0376	479.6196	433.8723	361.2826	275.3137	184.6820	122.6286	128.7500	200.3529	307.8275	411.4416	498.7023 (97)
Space heating kWh	99.4116	64.6562	40.0309	13.3562	2.8281	0.0000	0.0000	0.0000	0.0000	15.3601	55.0006	103.3077 (98a)
Space heating requirement - total per year (kWh/year)												393.9515
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	99.4116	64.6562	40.0309	13.3562	2.8281	0.0000	0.0000	0.0000	0.0000	15.3601	55.0006	103.3077 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												393.9515
Space heating per m2												(98c) / (4) = 10.3972 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP												
Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
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	99.4116	64.6562	40.0309	13.3562	2.8281	0.0000	0.0000	0.0000	0.0000	15.3601	55.0006	103.3077 (98)
Space heating efficiency (main heating system 1)	360.0933	360.0933	360.0933	360.0933	360.0933	0.0000	0.0000	0.0000	0.0000	360.0933	360.0933	360.0933 (210)
Space heating fuel (main heating system)	27.6072	17.9554	11.1168	3.7091	0.7854	0.0000	0.0000	0.0000	0.0000	4.2656	15.2740	28.6891 (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	174.4134	154.3831	164.4069	145.5479	141.7569	128.4665	127.3389	131.9963	132.9994	147.4265	155.6795	172.6441 (64)
Efficiency of water heater (217)m	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571	197.5571 (216)
Fuel for water heating, kWh/month	88.2850	78.1461	83.2200	73.6738	71.7549	65.0275	64.4567	66.8142	67.3220	74.6248	78.8023	87.3895 (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	4.6746	4.2222	4.6746	4.5238	4.6746	4.5238	4.6746	4.6746	4.5238	4.6746	4.5238	4.6746 (231)
Lighting	13.3454	10.7062	9.6397	7.0625	5.4553	4.4570	4.9765	6.4686	8.4021	11.0240	12.4516	13.7163 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-37.2945	-52.7205	-75.5647	-83.0615	-88.1531	-81.8625	-80.9222	-77.5399	-69.7199	-59.3622	-40.8131	-32.1709 (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	-22.2155	-49.2976	-104.2160	-164.7210	-222.4870	-225.0490	-221.3242	-183.7897	-130.3787	-72.8087	-30.3373	-17.2335 (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												109.4026 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												197.5571
Water heating fuel used												899.5168 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.4840) mechanical ventilation fans (SFP = 0.4840)	55.0392 (230a) 55.0392 (231)
Total electricity for the above, kWh/year	107.7053 (232)
Electricity for lighting (calculated in Appendix L)	
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	-1051.3794 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	109.4026	16.4900	18.0405 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	899.5168	16.4900	148.3303 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	55.0392	16.4900	9.0760 (249)
Energy for lighting	107.7053	16.4900	17.7606 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-779.1850	16.4900	-128.4876
PV Unit electricity exported	-1443.8583	5.5900	-80.7117
Total			-209.1993 (252)
Total energy cost			-15.9919 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = -0.0695 (257)
SAP value	101.1259
SAP rating (Section 12)	101 (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	109.4026	0.1579	17.2706 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	899.5168	0.1407	126.5806 (264)
Space and water heating			143.8512 (265)
Pumps, fans and electric keep-hot	55.0392	0.1387	7.6346 (267)
Energy for lighting	107.7053	0.1443	15.5452 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-779.1850	0.1348	-105.0657
PV Unit electricity exported	-1443.8583	0.1247	-180.0824
Total			-285.1482 (269)
Total CO2, kg/year			-118.1172 (272)
CO2 emissions per m2			-3.1200 (273)
EI value			101.9095
EI rating			102 (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	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	93.2109 (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)

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Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour	0.0000 / (5) = 0.0000 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			0.7500 (17)
Infiltration rate			0.0375 (18)
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.0291 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	7.0000	6.5000	6.4000	5.8000	5.7000	5.0000	4.9000	4.8000	5.5000	6.2000	6.3000	6.9000 (22)
Wind factor	1.7500	1.6250	1.6000	1.4500	1.4250	1.2500	1.2250	1.2000	1.3750	1.5500	1.5750	1.7250 (22a)
Adj infiltr rate	0.0509	0.0472	0.0465	0.0421	0.0414	0.0363	0.0356	0.0349	0.0400	0.0450	0.0458	0.0501 (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) =												81.9000 (23c)
Effective ac	0.1414	0.1377	0.1370	0.1326	0.1319	0.1268	0.1261	0.1254	0.1305	0.1355	0.1363	0.1406 (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 = 0.79)			1.5600	0.7658	1.1946		(27)
Door			5.6700	0.7900	4.4793		(26a)
5			0.7800	1.0536	0.8218		(27a)
6			1.2000	1.0536	1.2644		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000 (28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700 (29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700 (29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400 (30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900 (30)
Total net area of external elements Aum(A, m2)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.2981	(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000 (32)
Internal Wall 1 GF			43.4700			9.0000	391.2300 (32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800 (32c)
Internal Floor 1			11.8900			18.0000	214.0200 (32d)
Internal Ceiling 1			11.8900			9.0000	107.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7323.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.2703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360

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

Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	27.4138 (37)

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

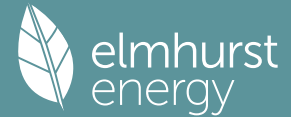
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	4.3482	4.2364	4.2141	4.0800	4.0576	3.9012	3.8788	3.8565	4.0129	4.1694	4.1917	4.3258 (38)
Average = Sum(39)m / 12 =	31.7619	31.6502	31.6278	31.4937	31.4714	31.3149	31.2926	31.2702	31.4267	31.5831	31.6055	31.7396 (39)
												31.5198

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8383	0.8353	0.8347	0.8312	0.8306	0.8265	0.8259	0.8253	0.8294	0.8335	0.8341	0.8377 (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													1.3515 (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	53.9672	53.1657	52.0371	49.9560	48.3977	46.6699	45.7366	46.8573	48.0776	49.9265	52.0504	53.7848	53.7848 (42b)
Hot water usage for other uses	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702	28.4702 (42c)
Average daily hot water use (litres/day)													75.9181 (43)
Daily hot water use	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550	82.2550 (44)
Energy conte	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915	128.7915 (45)
Energy content (annual)													Total = Sum(45)m = 1260.7304
Distribution loss (46)m = 0.15 x (45)m													

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh												
60.5040	40.4653	26.3661	10.1320	2.7220	0.0000	0.0000	0.0000	0.0000	7.4188	27.5539	58.4049 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												233.5669
Space heating per m ²									(98c) / (4) =			6.1643 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												361.2773 (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	60.5040	40.4653	26.3661	10.1320	2.7220	0.0000	0.0000	0.0000	0.0000	7.4188	27.5539	58.4049 (98)
Space heating efficiency (main heating system 1)	361.2773	361.2773	361.2773	361.2773	361.2773	0.0000	0.0000	0.0000	0.0000	361.2773	361.2773	361.2773 (210)
Space heating fuel (main heating system)	16.7472	11.2006	7.2980	2.8045	0.7534	0.0000	0.0000	0.0000	0.0000	2.0535	7.6268	16.1662 (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	174.4134	154.3831	164.4069	145.5479	141.7569	128.4665	127.3389	131.9963	132.9994	147.4265	155.6795	172.6441 (64)
Efficiency of water heater												
(217)m	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488 (216)
Fuel for water heating, kWh/month	88.2887	78.1493	83.2234	73.6769	71.7579	65.0303	64.4594	66.8170	67.3248	74.6279	78.8056	87.3931 (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	4.6746	4.2222	4.6746	4.5238	4.6746	4.5238	4.6746	4.5238	4.5238	4.6746	4.5238	4.6746 (231)
Lighting	13.3454	10.7062	9.6397	7.0625	5.4553	4.4570	4.9765	6.4686	8.4021	11.0240	12.4516	13.7163 (232)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-45.6046	-57.4842	-80.6257	-88.2033	-90.8240	-86.2261	-83.1185	-82.0658	-75.5350	-65.5983	-48.7592	-39.4401 (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	-33.5891	-60.9424	-124.7614	-199.4017	-248.2612	-280.1418	-246.2385	-224.8237	-165.0125	-93.1139	-44.5720	-26.0814 (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												64.6503 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												197.5488
Water heating fuel used												899.5545 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.4840) mechanical ventilation fans (SFP = 0.4840)												55.0392 (230a)
Total electricity for the above, kWh/year												55.0392 (231)
Electricity for lighting (calculated in Appendix L)												107.7053 (232)

Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-2590.4245 (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												-1463.4752 (238)

10a. Fuel costs - using BEDF prices (538)			
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	64.6503	25.1600	16.2660 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	899.5545	25.1600	226.3279 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	55.0392	25.1600	13.8479 (249)
Energy for lighting	107.7053	25.1600	27.0987 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-843.4848	25.1600	-212.2208
PV Unit electricity exported	-1746.9398	5.8100	-101.4972
Total			-313.7180 (252)
Total energy cost			-30.1775 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

Full SAP Calculation Printout



Space heating - main system 1	64.6503	0.1578	10.2050 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	899.5545	0.1407	126.5859 (264)
Space and water heating			136.7909 (265)
Pumps, fans and electric keep-hot	55.0392	0.1387	7.6346 (267)
Energy for lighting	107.7053	0.1443	15.5452 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-843.4848	0.1355	-114.2613
PV Unit electricity exported	-1746.9398	0.1256	-219.4593
Total			-333.7206 (269)
Total CO2, kg/year			-173.7499 (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	64.6503	1.5843	102.4278 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	899.5545	1.5203	1367.6151 (278)
Space and water heating			1470.0429 (279)
Pumps, fans and electric keep-hot	55.0392	1.5128	83.2633 (281)
Energy for lighting	107.7053	1.5338	165.2020 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-843.4848	1.5007	-1265.8049
PV Unit electricity exported	-1746.9398	0.4611	-805.5608
Total			-2071.3658 (283)
Total Primary energy kWh/year			-352.8577 (286)

 SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 TG

Current energy efficiency rating:	A 101
Current environmental impact rating:	A 102

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:			
N Solar water heating	SAP change + 2.2	Cost change -£ 56	CO2 change -36 kg (20.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£56	0.95 kg/m ²	A 103 A 102
Total Savings	£56	0.95 kg/m²	

Potential energy efficiency rating:	A 103
Potential environmental impact rating:	A 102

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 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
Electricity	£284	£210	£73
Space heating	£30	£50	-£20
Water heating	£226	£133	£93
Lighting	£27	£27	£0
Generated (PV)	-£314	-£297	-£17
Total cost of fuels	-£130	-£87	£56
Total cost of uses	-£31	-£87	£56
Delivered energy	-39 kWh/m ²	-46 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	-0.2 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m ²	-5 kg/m ²	-6 kg/m ²	1 kg/m ²
Primary energy	-9 kWh/m ²	-18 kWh/m ²	9 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	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 93.2109 (5)

Full SAP Calculation Printout



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	
Measured/design AP50												0.7500	(17)
Infiltration rate												0.0375	(18)
Number of sides sheltered												3	(19)
												(20) = 1 - [0.075 x (19)] =	
Shelter factor												0.7750	(20)
												(21) = (18) x (20) =	
Infiltration rate adjusted to include shelter factor												0.0291	(21)
												(22) = (21) x (20) =	
Infiltration rate												0.0341	(22)
Adj infilt rate	0.0371	0.0363	0.0356	0.0320	0.0312	0.0276	0.0276	0.0269	0.0291	0.0312	0.0327	0.0341	(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)												81.9000	(23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.1276	(23c)
Effective ac	0.1276	0.1268	0.1261	0.1225	0.1217	0.1181	0.1181	0.1174	0.1196	0.1217	0.1232	0.1246	(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 = 0.79)			1.5600	0.7658	1.1946			(27)
Door			5.6700	0.7900	4.4793			(26a)
5			0.7800	1.0536	0.8218			(27a)
6			1.2000	1.0536	1.2644			(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000	(28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700	(29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700	(29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400	(30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900	(30)
Total net area of external elements Aum(A, m2)			121.0400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.2981		(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000	(32)
Internal Wall 1 GF			43.4700			9.0000	391.2300	(32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800	(32c)
Internal Floor 1			11.8900			18.0000	214.0200	(32d)
Internal Ceiling 1			11.8900			9.0000	107.0100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	7323.0100		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						193.2703		(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360

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

Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	27.4138 (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	3.9235	3.9012	3.8788	3.7671	3.7447	3.6330	3.6330	3.6106	3.6777	3.7447	3.7894	3.8341 (38)
Average = Sum(39)m / 12 =	31.3373	31.3149	31.2926	31.1808	31.1585	31.0467	31.0467	31.0244	31.0914	31.1585	31.2032	31.2479 (39)
HLP	0.8271	0.8265	0.8259	0.8229	0.8223	0.8194	0.8194	0.8188	0.8206	0.8223	0.8235	0.8247 (40)
HLP (average)												0.8228
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3515 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Hot water usage for other uses	53.9672	53.1657	52.0371	49.9560	48.3977	46.6699	45.7366	46.8573	48.0776	49.9265	52.0504	53.7848 (42b)
Average daily hot water use (litres/day)	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702 (42c) 75.9181 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550 (44)
Distribution loss (46)m = 0.15 x (45)m	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915 (45) Total = Sum(45)m = 1260.7304
Water storage loss:	19.5841	17.2161	18.0832	15.4665	14.6856	12.9043	12.5229	13.2216	13.5842	15.5361	16.9862	19.3187 (46)
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6642 (55)
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902 (56)
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902 (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	174.4134	154.3831	163.0112	138.7943	128.9626	115.8598	114.3119	119.8998	127.5965	146.0308	155.6795	172.6441 (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												547.4954 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												547.4954
Solar input	-0.0000	-16.3583	-54.5432	-71.7314	-88.9984	-81.3855	-80.5218	-72.7447	-53.0163	-28.1958	-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 (63a)
Output from w/h	174.4134	138.0248	108.4680	67.0629	39.9642	34.4743	33.7902	47.1551	74.5802	117.8350	155.6795	172.6441 (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	78.4935	69.8495	74.0498	62.8316	57.3998	52.4695	52.4197	54.7127	59.7398	68.4038	71.6032	77.9052 (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	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.2468	13.5421	11.0132	8.3377	6.2325	5.2617	5.6855	7.3902	9.9191	12.5946	14.6998	15.6706 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.5310	175.3317	170.7939	161.1337	148.9393	137.4783	129.8216	128.0209	132.5587	142.2190	154.4133	165.8743 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602 (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)	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582 (71)
Water heating gains (Table 5)	105.5021	103.9427	99.5293	87.2660	77.1503	72.8743	70.4566	73.5386	82.9719	91.9406	99.4489	104.7113 (72)
Total internal gains	365.7691	364.3057	352.8257	328.2266	303.8113	287.1036	277.4530	280.4390	296.9390	318.2435	340.0513	357.7455 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	or Table 6c	factor	W						
		W/m2			Table 6d							
Southwest	1.0800	36.7938	0.6800	0.7000	0.7700	13.1081 (79)						
Northwest	0.4800	11.2829	0.6800	0.7000	0.7700	1.7865 (81)						
Southwest	0.7800	26.0000	0.6800	0.7000	1.0000	8.6880 (82)						
Horizontal	1.2000	26.0000	0.6800	0.7000	1.0000	13.3661 (82)						
Solar gains	36.9486	71.7689	118.5321	175.8476	219.7224	227.1578	215.3215	181.8618	138.6093	85.1045	45.9400	30.4896 (83)
Total gains	402.7177	436.0746	471.3577	504.0743	523.5338	514.2614	492.7746	462.3008	435.5483	403.3479	385.9913	388.2351 (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	64.9121	64.9584	65.0048	65.2378	65.2846	65.5196	65.5196	65.5668	65.4254	65.2846	65.1911	65.0978
util living area	5.3275	5.3306	5.3337	5.3492	5.3523	5.3680	5.3680	5.3711	5.3617	5.3523	5.3461	5.3399
	0.9295	0.8963	0.8256	0.7010	0.5428	0.3849	0.2770	0.3083	0.4869	0.7382	0.8871	0.9390 (86)
Living	20.5267	20.6262	20.7620	20.8753	20.9265	20.9402	20.9420	20.9418	20.9353	20.8688	20.6875	20.4949
Non living	19.6912	19.8108	19.9695	20.0960	20.1470	20.1612	20.1623	20.1628	20.1567	20.0929	19.8891	19.6544
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

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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	109.8532	16.4900	18.1148 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	589.2431	16.4900	97.1662 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	55.0392	16.4900	9.0760 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	107.7053	16.4900	17.7606 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-713.4683	16.4900	-117.6509
PV Unit electricity exported	-1509.5750	5.5900	-84.3852
Total			-202.0362 (252)
Total energy cost			-46.7266 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.2029 (257)
SAP value		103.2896
SAP rating (Section 12)		103 (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	109.8532	0.1578	17.3346 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	589.2431	0.1477	87.0210 (264)
Space and water heating			104.3556 (265)
Pumps, fans and electric keep-hot	135.0392	0.1387	18.7316 (267)
Energy for lighting	107.7053	0.1443	15.5452 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-713.4683	0.1359	-96.9417
PV Unit electricity exported	-1509.5750	0.1243	-187.6090
Total			-284.5507 (269)
Total CO2, kg/year			-145.9183 (272)
CO2 emissions per m2			-3.8500 (273)
EI value			102.3589
EI rating			102 (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

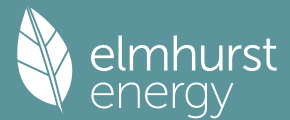
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	26.0000 (1b)	x 2.3000 (2b)	= 59.8000 (1b) - (3b)
First floor	11.8900 (1c)	x 2.8100 (2c)	= 33.4109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.8900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 93.2109 (5)

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	0.7500 (17)
Infiltration rate	0.0375 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0291 (21)

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

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Wind speed	7.0000	6.5000	6.4000	5.8000	5.7000	5.0000	4.9000	4.8000	5.5000	6.2000	6.3000	6.9000 (22)
Wind factor	1.7500	1.6250	1.6000	1.4500	1.4250	1.2500	1.2250	1.2000	1.3750	1.5500	1.5750	1.7250 (22a)
Adj infilt rate												
	0.0509	0.0472	0.0465	0.0421	0.0414	0.0363	0.0356	0.0349	0.0400	0.0450	0.0458	0.0501 (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) =												81.9000 (23c)
Effective ac	0.1414	0.1377	0.1370	0.1326	0.1319	0.1268	0.1261	0.1254	0.1305	0.1355	0.1363	0.1406 (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 = 0.79)			1.5600	0.7658	1.1946		(27)
Door			5.6700	0.7900	4.4793		(26a)
5			0.7800	1.0536	0.8218		(27a)
6			1.2000	1.0536	1.2644		(27a)
Floor 1 P/a 0.65			26.0000	0.1300	3.3800	110.0000	2860.0000 (28a)
External Wall 1 Ground Floor	39.3600	7.2300	32.1300	0.1300	4.1769	9.0000	289.1700 (29a)
External Wall 2 First Floor	28.5300		28.5300	0.1300	3.7089	9.0000	256.7700 (29a)
External Roof 1 Sloping	13.0400	0.7800	12.2600	0.1300	1.5938	9.0000	110.3400 (30)
External Roof 2 Flat	14.1100	1.2000	12.9100	0.1300	1.6783	9.0000	116.1900 (30)
Total net area of external elements Aum(A, m2)			121.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2981		(33)
Party Wall 1			16.0900	0.0000	0.0000	180.0000	2896.2000 (32)
Internal Wall 1 GF			43.4700			9.0000	391.2300 (32c)
Internal Wall 2 FF			9.1200			9.0000	82.0800 (32c)
Internal Floor 1			11.8900			18.0000	214.0200 (32d)
Internal Ceiling 1			11.8900			9.0000	107.0100 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7323.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.2703 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	11.8700	0.0300	0.3561
E5 Ground floor (normal)	17.1100	0.0210	0.3593
E11 Eaves (insulation at rafter level)	8.2000	0.0390	0.3198
E6 Intermediate floor within a dwelling	4.1000	0.0800	0.3280
E18 Party wall between dwellings	9.5700	0.0395	0.3780
R4 Ridge (vaulted ceiling)	4.1000	0.1200	0.4920
E13 Gable (insulation at rafter level)	3.1800	0.0240	0.0763
E14 Flat roof	13.0100	0.0460	0.5985
E15 Flat roof with parapet	7.0000	0.0460	0.3220
P1 Party wall - Ground floor	3.4500	0.1490	0.5141
P2 Party wall - Intermediate floor within a dwelling	3.1800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	2.9000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	0.5500	0.0000	0.0000
E2 Other lintels (including other steel lintels)	4.8000	0.0840	0.4032
E3 Sill	2.1000	0.0430	0.0903
E4 Jamb	15.8000	0.0340	0.5372
R1 Head of roof window	0.6600	0.0770	0.0508
R2 Sill of roof window	0.6600	0.0820	0.0541
R3 Jamb of roof window	2.3600	0.1000	0.2360
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.1157 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 27.4138 (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	4.3482	4.2364	4.2141	4.0800	4.0576	3.9012	3.8788	3.8565	4.0129	4.1694	4.1917	4.3258 (38)
Heat transfer coeff	31.7619	31.6502	31.6278	31.4937	31.4714	31.3149	31.2926	31.2702	31.4267	31.5831	31.6055	31.7396 (39)
Average = Sum(39)m / 12 =												31.5198
HLP	0.8383	0.8353	0.8347	0.8312	0.8306	0.8265	0.8259	0.8253	0.8294	0.8335	0.8341	0.8377 (40)
HLP (average)												0.8319
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3515 (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	53.9672	53.1657	52.0371	49.9560	48.3977	46.6699	45.7366	46.8573	48.0776	49.9265	52.0504	53.7848 (42b)
Hot water usage for other uses	28.4702	27.4350	26.3997	25.3644	24.3291	23.2938	23.2938	24.3291	25.3644	26.3997	27.4350	28.4702 (42c)
Average daily hot water use (litres/day)												75.9181 (43)
Daily hot water use	82.4375	80.6007	78.4367	75.3204	72.7269	69.9637	69.0304	71.1864	73.4420	76.3262	79.4854	82.2550 (44)
Energy conte	130.5608	114.7743	120.5543	103.1099	97.9043	86.0285	83.4863	88.1437	90.5614	103.5739	113.2415	128.7915 (45)
Energy content (annual)												Total = Sum(45)m = 1260.7304
Distribution loss (46)m = 0.15 x (45)m	19.5841	17.2161	18.0832	15.4665	14.6856	12.9043	12.5229	13.2216	13.5842	15.5361	16.9862	19.3187 (46)
Water storage loss:												170.0000 (47)
Store volume												1.2300 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.6642 (55)
Enter (49) or (54) in (55)												
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902 (56)
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902 (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	174.4134	154.3831	163.0112	138.7943	128.9626	115.8598	114.3119	119.8998	127.5965	146.0308	155.6795	172.6441 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)

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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													667.3985 (H24)
Heat delivered to space heating													0.0000 (H29)
Solar input													667.3985
Solar input	-8.1868	-25.8829	-66.4828	-84.5715	-95.9976	-94.1164	-86.0542	-84.7222	-67.0582	-41.5305	-12.7953		-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													
	166.2265	128.5002	96.5284	54.2228	32.9650	21.7434	28.2577	35.1776	60.5383	104.5003	142.8842		172.6441 (64)
													Total per year (kWh/year) = Sum(64)m = 1044.1885 (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													
	78.4935	69.8495	74.0498	62.8316	57.3998	52.4695	52.4197	54.7127	59.7398	68.4038	71.6032		77.9052 (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	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	81.0873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.2468	13.5421	11.0132	8.3377	6.2325	5.2617	5.6855	7.3902	9.9191	12.5946	14.6998	15.6706	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.5310	175.3317	170.7939	161.1337	148.9393	137.4783	129.8216	128.0209	132.5587	142.2190	154.4133	165.8743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	44.4602	(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)													
	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	-54.0582	(71)
Water heating gains (Table 5)													
	105.5021	103.9427	99.5293	87.2660	77.1503	72.8743	70.4566	73.5386	82.9719	91.9406	99.4489	104.7113	(72)
Total internal gains	365.7691	364.3057	352.8257	328.2266	303.8113	287.1036	277.4530	280.4390	296.9390	318.2435	340.0513	357.7455	(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							
Southwest		1.0800	46.7636	0.6800	0.7000	0.7700	16.6599	(79)					
Northwest		0.4800	15.4361	0.6800	0.7000	0.7700	2.4441	(81)					
Southwest		0.7800	36.0000	0.6800	0.7000	1.0000	12.0295	(82)					
Horizontal		1.2000	36.0000	0.6800	0.7000	1.0000	18.5069	(82)					
Solar gains	49.6403	84.2294	137.0502	206.4757	242.2612	273.6257	236.8743	215.9275	168.6434	103.3758	60.8658	40.8035	(83)
Total gains	415.4094	448.5351	489.8759	534.7024	546.0726	560.7294	514.3273	496.3665	465.5824	421.6193	400.9171	398.5489	(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)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.0443	64.2704	64.3158	64.5897	64.6355	64.9584	65.0048	65.0513	64.7275	64.4069	64.3613	64.0894	
alpha	5.2696	5.2847	5.2877	5.3060	5.3090	5.3306	5.3337	5.3368	5.3152	5.2938	5.2908	5.2726	
util living area	0.8780	0.8417	0.7707	0.6608	0.5320	0.3784	0.3099	0.3083	0.4421	0.6503	0.8052	0.8826	(86)
Living	20.6839	20.7415	20.8216	20.8907	20.9267	20.9397	20.9413	20.9414	20.9373	20.9047	20.8108	20.6839	
Non living	19.8718	19.9396	20.0288	20.1043	20.1399	20.1545	20.1561	20.1567	20.1503	20.1187	20.0214	19.8733	
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	20.8383	20.7415	20.8216	20.8907	20.9267	20.9397	20.9413	20.9414	20.9373	20.9047	20.8108	20.7281	(87)
Th 2	20.2203	20.2228	20.2233	20.2264	20.2269	20.2305	20.2310	20.2315	20.2279	20.2244	20.2238	20.2208	(88)
util rest of house													
	0.8570	0.8172	0.7403	0.6248	0.4910	0.3361	0.2633	0.2601	0.3917	0.6033	0.7722	0.8614	(89)
MIT 2	20.0814	19.9396	20.0288	20.1043	20.1399	20.1545	20.1561	20.1567	20.1503	20.1187	20.0214	19.9359	(90)
Living area fraction													FLA = Living area / (4) = 0.4970 (91)
MIT	20.4575	20.3381	20.4228	20.4951	20.5309	20.5447	20.5463	20.5466	20.5414	20.5093	20.4137	20.3296	(92)
Temperature adjustment													0.0000
adjusted MIT	20.4575	20.3381	20.4228	20.4951	20.5309	20.5447	20.5463	20.5466	20.5414	20.5093	20.4137	20.3296	(93)

8. Space heating requirement

Utilisation	0.8638	0.8210	0.7484	0.6375	0.5072	0.3534	0.2824	0.2799	0.4123	0.6209	0.7807	0.8646	(94)
Useful gains	358.8189	368.2680	366.6139	340.8920	276.9935	198.1751	145.2711	138.9346	191.9516	261.8000	312.9848	344.5753	(95)
Ext temp.	6.6000	6.8000	7.7000	9.2000	11.6000	14.2000	15.9000	16.1000	14.4000	11.9000	9.3000	7.0000	(96)
Heat loss rate W													
	440.1415	428.4842	402.3938	355.7252	281.0683	198.6843	145.3947	139.0471	193.0037	271.9082	351.2540	423.0765	(97)
Space heating kWh													
	60.5040	40.4653	26.6202	10.6799	3.0317	0.0000	0.0000	0.0000	0.0000	7.5205	27.5539	58.4049	(98a)
Space heating requirement - total per year (kWh/year)													234.7803
Solar heating kWh													

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Solar heating contribution - total per year (kWh/year)	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Space heating kWh	60.5040	40.4653	26.6202	10.6799	3.0317	0.0000	0.0000	0.0000	0.0000	7.5205	27.5539	58.4049	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												234.7803	
Space heating per m2												6.1964	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													361.2773	(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	60.5040	40.4653	26.6202	10.6799	3.0317	0.0000	0.0000	0.0000	0.0000	7.5205	27.5539	58.4049	(98)	
Space heating efficiency (main heating system 1)	361.2773	361.2773	361.2773	361.2773	361.2773	0.0000	0.0000	0.0000	0.0000	361.2773	361.2773	361.2773	(210)	
Space heating fuel (main heating system)	16.7472	11.2006	7.3684	2.9561	0.8392	0.0000	0.0000	0.0000	0.0000	2.0816	7.6268	16.1662	(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	166.2265	128.5002	96.5284	54.2228	32.9650	21.7434	28.2577	35.1776	60.5383	104.5003	142.8842	172.6441	(64)	
Efficiency of water heater														
(217)m	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	197.5488	(216)	
Fuel for water heating, kWh/month	84.1445	65.0473	48.8631	27.4478	16.6870	11.0066	14.3042	17.8070	30.6447	52.8985	72.3285	87.3931	(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	11.4691	10.3592	11.4691	11.0991	11.4691	11.0991	11.4691	11.0991	11.4691	11.0991	11.4691	11.4691	(231)	
Lighting	13.3454	10.7062	9.6397	7.0625	5.4553	4.4570	4.9765	6.4686	8.4021	11.0240	12.4516	13.7163	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-45.7315	-56.8457	-76.0698	-77.7019	-75.1464	-68.3264	-68.0181	-68.3505	-67.8940	-63.4465	-48.7661	-39.7029	(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	-33.4623	-61.5809	-129.3174	-209.9032	-263.9388	-298.0415	-261.3389	-238.5390	-172.6535	-95.2656	-44.5651	-25.8186	(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													64.9862	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													197.5488	
Water heating fuel used													528.5724	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.4840)														
mechanical ventilation fans (SFP = 0.4840)													55.0392	(230a)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													135.0392	(231)
Electricity for lighting (calculated in Appendix L)													107.7053	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2590.4245	(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													-1754.1215	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	64.9862	25.1600	16.3505	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	528.5724	25.1600	132.9888	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	55.0392	25.1600	13.8479	(249)
Pump for solar water heating	80.0000	25.1600	20.1280	(249)
Energy for lighting	107.7053	25.1600	27.0987	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-755.9996	25.1600	-190.2095	
PV Unit electricity exported	-1834.4249	5.8100	-106.5801	
Total			-296.7896	(252)
Total energy cost			-86.3758	(255)

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

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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	64.9862	0.1578	10.2526 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	528.5724	0.1489	78.7294 (264)
Space and water heating			88.9820 (265)
Pumps, fans and electric keep-hot	135.0392	0.1387	18.7316 (267)
Energy for lighting	107.7053	0.1443	15.5452 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-755.9996	0.1367	-103.3704
PV Unit electricity exported	-1834.4249	0.1252	-229.6288
Total			-332.9992 (269)
Total CO2, kg/year			-209.7404 (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	64.9862	1.5840	102.9399 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	528.5724	1.5511	819.8665 (278)
Space and water heating			922.8065 (279)
Pumps, fans and electric keep-hot	135.0392	1.5128	204.2873 (281)
Energy for lighting	107.7053	1.5338	165.2020 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-755.9996	1.5055	-1138.1270
PV Unit electricity exported	-1834.4249	0.4595	-842.8619
Total			-1980.9888 (283)
Total Primary energy kWh/year			-688.6931 (286)