Full SAP Calculation Printout

Property Reference	CPG-7172-23 P3	**Issued on Date**	12/01/2024
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	**Prop Type Ref**	DS
Property	Plot 3, Collygree Parc, South Road, Penzance, Cornwall, TR20 9LY		

SAP Rating	98 A	**DER**	-0.29	**TER**	9.63
Environmental	100 A	**% DER < TER**			103.01
CO_2 Emissions (t/year)	-0.11	**DFEE**	28.39	**TFEE**	32.74
Compliance Check	See BREL	**% DFEE < TFEE**			13.28
% DPER < TPER	86.75	**DPER**	6.66	**TPER**	50.24

Assessor Details	Mr. Stuart Thomas	**Assessor ID**	V220-0003
Client	Cornwall Planning Group, CPG		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200 (1b)	x	2.3700 (2b)	=	124.9464	(1b) - (3b)
First floor	52.7200 (1c)	x	2.6200 (2c)	=	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	263.0728	(5)

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2. Ventilation rate

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		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		1.0000	(17)
Infiltration rate		0.0500	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0350	(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	0.0446	0.0437	0.0429	0.0385	0.0376	0.0332	0.0332	0.0324	0.0350	0.0376	0.0394	0.0411	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.1396	0.1387	0.1379	0.1335	0.1326	0.1282	0.1282	0.1274	0.1300	0.1326	0.1344	0.1361	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10890.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 103.2880 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9917 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.1214	12.0454	11.9695	11.5897	11.5137	11.1339	11.1339	11.0579	11.2858	11.5137	11.6656	11.8176	(38)
Heat transfer coeff	64.4290	64.3530	64.2771	63.8973	63.8213	63.4415	63.4415	63.3655	63.5934	63.8213	63.9732	64.1252	(39)
Average = Sum(39)m / 12 =												63.8783	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6110	0.6103	0.6096	0.6060	0.6053	0.6017	0.6017	0.6010	0.6031	0.6053	0.6067	0.6082	(40)
HLP (average)												0.6058	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7845 (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

81.7862	80.5716	78.8611	75.7073	73.3458	70.7272	69.3128	71.0113	72.8607	75.6626	78.8814	81.5097	(42b)

Hot water usage for other uses

43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)

Average daily hot water use (litres/day) 115.0524 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
Energy conte	197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)
Energy content (annual)											Total = Sum(45)m =	1910.6116	
Distribution loss (46)m = 0.15 x (45)m	29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(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	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.8676	(64)
12Total per year (kWh/year)												2500	(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	105.8263	93.9970	100.7841	90.7024	89.3708	82.0951	82.1056	84.4525	84.3792	92.2277	95.8077	104.9348	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.1195	166.2037	150.1195	155.1234	150.1195	155.1234	150.1195	150.1195	155.1234	150.1195	155.1234	150.1195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.8343	267.5824	260.6572	245.9141	227.3037	209.8125	198.1273	195.3792	202.3044	217.0475	235.6579	253.1491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)	142.2397	139.8765	135.4625	125.9755	120.1221	114.0210	110.3570	113.5114	117.1933	123.9620	133.0662	141.0413	(72)
Total internal gains	621.9609	638.4301	611.0067	591.7806	562.3128	543.7245	523.3713	523.7775	539.3887	555.8964	588.6151	609.0774	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

North				4.4900	10.6334	0.7600	0.7000	0.7700				17.6020	(74)
South				7.4700	46.7521	0.7600	0.7000	0.7700				128.7556	(78)
Solar gains	146.3577	244.5070	325.7690	395.4000	440.0371	436.8539	421.0821	386.9543	349.3186	267.4837	174.3337	125.9307	(83)
Total gains	768.3186	882.9371	936.7757	987.1807	1002.3499	980.5784	944.4534	910.7318	888.7074	823.3801	762.9488	735.0081	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.9539	47.0093	47.0649	47.3446	47.4010	47.6847	47.6847	47.7419	47.5708	47.4010	47.2884	47.1764	
alpha	4.1303	4.1340	4.1377	4.1563	4.1601	4.1790	4.1790	4.1828	4.1714	4.1601	4.1526	4.1451	
util living area	0.9135	0.8638	0.8033	0.6974	0.5629	0.4079	0.2943	0.3182	0.4802	0.7111	0.8623	0.9243	(86)
Living	20.2738	20.4490	20.6126	20.7778	20.8745	20.9155	20.9240	20.9232	20.9050	20.7892	20.5220	20.2317	
Non living	19.5567	19.7727	19.9722	20.1703	20.2795	20.3248	20.3322	20.3323	20.3137	20.1871	19.8684	19.5068	
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	20.6285	20.4490	20.6126	20.7778	20.8745	20.9155	20.9240	20.9232	20.9050	20.7892	20.5220	20.3392	(87)
Th 2	20.4201	20.4207	20.4214	20.4246	20.4252	20.4285	20.4285	20.4291	20.4272	20.4252	20.4240	20.4227	(88)
util rest of house	0.9048	0.8514	0.7865	0.6740	0.5331	0.3731	0.2565	0.2793	0.4435	0.6841	0.8478	0.9165	(89)
MIT 2	20.0759	19.7727	19.9722	20.1703	20.2795	20.3248	20.3322	20.3323	20.3137	20.1871	19.8684	19.6718	(90)
Living area fraction										fLA = Living area / (4) =		0.2211	(91)
MIT	20.1981	19.9222	20.1138	20.3046	20.4110	20.4554	20.4630	20.4629	20.4444	20.3202	20.0129	19.8194	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1981	19.9222	20.1138	20.3046	20.4110	20.4554	20.4630	20.4629	20.4444	20.3202	20.0129	19.8194	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9012	0.8399	0.7770	0.6690	0.5323	0.3747	0.2588	0.2817	0.4446	0.6789	0.8366	0.9074	(94)
Useful gains	692.4077	741.5761	727.8565	660.4163	533.5570	367.4532	244.4303	256.5135	395.1510	559.0192	638.2489	666.9098	(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	1024.2959	966.7254	875.0525	728.7211	555.9485	371.4742	245.0772	257.4510	403.4646	620.3553	826.0811	1001.5948	(97)
Space heating kWh	246.9248	151.3003	109.5138	49.1795	16.6593	0.0000	0.0000	0.0000	0.0000	45.6341	135.2392	249.0057	(98a)
Space heating requirement - total per year (kWh/year)												1003.4566	
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	246.9248	151.3003	109.5138	49.1795	16.6593	0.0000	0.0000	0.0000	0.0000	45.6341	135.2392	249.0057	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1003.4566	
Space heating per m2										(98c) / (4) =		9.5168	(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 %)												402.1577	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	246.9248	151.3003	109.5138	49.1795	16.6593	0.0000	0.0000	0.0000	0.0000	45.6341	135.2392	249.0057	(98)
Space heating efficiency (main heating system 1)	402.1577	402.1577	402.1577	402.1577	402.1577	0.0000	0.0000	0.0000	0.0000	402.1577	402.1577	402.1577	(210)
Space heating fuel (main heating system)	61.4000	37.6221	27.2315	12.2289	4.1425	0.0000	0.0000	0.0000	0.0000	11.3473	33.6284	61.9174	(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	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(64)
Efficiency of water heater												204.6600	(216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(217)
Fuel for water heating, kWh/month	121.1319	107.0758	113.7223	100.0161	96.9503	87.3676	86.2739	89.7227	90.7241	101.1485	107.5184	119.8218	(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	15.5920	14.0831	15.5920	15.0890	15.5920	15.0890	15.5920	15.5920	15.0890	15.5920	15.0890	15.5920	(231)
Lighting	29.0242	23.2843	20.9649	15.3598	11.8644	9.6933	10.8231	14.0682	18.2732	23.9755	27.0802	29.8309	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.3917	-68.6376	-101.3467	-116.2439	-127.4805	-119.4908	-117.9723	-110.4190	-96.5315	-79.0643	-52.5168	-40.7387	(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	-20.2251	-44.1954	-90.8208	-141.2984	-190.6912	-193.3227	-190.7072	-159.2758	-114.6937	-65.1777	-27.6865	-15.8450	(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												249.5182	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	204.6600	
Water heating fuel used	1221.4734	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)		
mechanical ventilation fans (SFP = 0.5720)	183.5827	(230a)
Total electricity for the above, kWh/year	183.5827	(231)
Electricity for lighting (calculated in Appendix L)	234.2419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2331.7732	(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	-442.9569	(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	249.5182	0.1571	39.2034	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1221.4734	0.1409	172.0761	(264)
Space and water heating			211.2795	(265)
Pumps, fans and electric keep-hot	183.5827	0.1387	25.4652	(267)
Energy for lighting	234.2419	0.1443	33.8083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.8337	0.1341	-144.5640	
PV Unit electricity exported	-1253.9394	0.1250	-156.7339	
Total			-301.2979	(269)
Total CO2, kg/year			-30.7449	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.2900	(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	249.5182	1.5816	394.6389	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1221.4734	1.5209	1857.7469	(278)
Space and water heating			2252.3858	(279)
Pumps, fans and electric keep-hot	183.5827	1.5128	277.7239	(281)
Energy for lighting	234.2419	1.5338	359.2881	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.8337	1.4957	-1612.0915	
PV Unit electricity exported	-1253.9394	0.4588	-575.2762	
Total			-2187.3677	(283)
Total Primary energy kWh/year			702.0302	(286)
Dwelling Primary energy Rate (DPER)			6.6600	(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	52.7200 (1b)	x	2.3700 (2b)	=	124.9464	(1b) - (3b)
First floor	52.7200 (1c)	x	2.6200 (2c)	=	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 105.4400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	263.0728	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1520	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4020	(18)

Number of sides sheltered 4 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7000 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2814 (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	0.3588	0.3518	0.3448	0.3096	0.3025	0.2674	0.2674	0.2603	0.2814	0.3025	0.3166	0.3307	(22b)
Effective ac	0.5644	0.5619	0.5594	0.5479	0.5458	0.5357	0.5357	0.5339	0.5396	0.5458	0.5501	0.5547	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.0000	2.1200			(26a)
TER Opening Type (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Floor 1 P/a 0.42			52.7200	0.1300	6.8536			(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1800	7.8660			(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1800	9.4500			(29a)
External Roof 1 Horz	52.7200		52.7200	0.1100	5.7992			(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7835			(33)
Party Wall 1			39.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 103.2880 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0900	1.7964
E5 Ground floor (normal)	22.1000	0.1600	3.5360
E10 Eaves (insulation at ceiling level)	11.1000	0.0600	0.6660
E12 Gable (insulation at ceiling level)	11.0000	0.0600	0.6600
E6 Intermediate floor within a dwelling	22.1000	0.0000	0.0000
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600
E2 Other lintels (including other steel lintels)	10.2100	0.0500	0.5105
E3 Sill	9.2000	0.0500	0.4600
E4 Jamb	24.3000	0.0500	1.2150

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4439 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 56.2274 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9960	48.7790	48.5663	47.5671	47.3801	46.5099	46.5099	46.3487	46.8451	47.3801	47.7583	48.1537	(38)
Heat transfer coeff	105.2234	105.0063	104.7936	103.7944	103.6075	102.7372	102.7372	102.5761	103.0724	103.6075	103.9857	104.3810	(39)
Average = Sum(39)m / 12 =												103.7935	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9979	0.9959	0.9939	0.9844	0.9826	0.9744	0.9744	0.9728	0.9775	0.9826	0.9862	0.9900	(40)
HLP (average)												0.9844	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7845 (42)

	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	81.7862	80.5716	78.8611	75.7073	73.3458	70.7272	69.3128	71.0113	72.8607	75.6626	78.8814	81.5097	(42b)
Hot water usage for other uses	43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)
Average daily hot water use (litres/day)												115.0524	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
Energy conte	197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)
Energy content (annual)										Total = Sum(45)m =		1910.6116	
Distribution loss (46)m = 0.15 x (45)m	29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)

Water storage loss:
Store volume 250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.8903 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0208 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.7690	223.5314	237.6045	209.3965	203.2788	183.5101	181.4286	188.4868	190.3795	211.8710	224.7508	250.0877	(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	252.7690	223.5314	237.6045	209.3965	203.2788	183.5101	181.4286	188.4868	190.3795	211.8710	224.7508	250.0877	(64)
										Total per year (kWh/year) = Sum(64)m =		2557.0947	(64)
12Total per year (kWh/year)												2557	(64)

Electric shower(s)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	109.7146	97.5090	104.6724	94.4652	93.2591	85.8580	85.9939	88.3408	88.1421	96.1160	99.5705	108.8231	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	150.1195	166.2037	150.1195	155.1234	150.1195	155.1234	150.1195	150.1195	155.1234	150.1195	155.1234	150.1195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	264.8343	267.5824	260.6572	245.9141	227.3037	209.8125	198.1273	195.3792	202.3044	217.0475	235.6579	253.1491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	(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)													
	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)													
	147.4659	145.1027	140.6887	131.2017	125.3483	119.2472	115.5832	118.7376	122.4196	129.1882	138.2924	146.2676	(72)
Total internal gains													
	630.1872	646.6564	619.2329	600.0068	570.5390	548.9507	528.5975	529.0038	544.6150	564.1227	596.8413	617.3037	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.6300	0.7000	0.7700	14.5912	(74)
South	7.4700	46.7521	0.6300	0.7000	0.7700	106.7317	(78)

Solar gains	121.3228	202.6834	270.0454	327.7658	364.7676	362.1289	349.0549	320.7647	289.5668	221.7299	144.5135	104.3899	(83)
Total gains	751.5100	849.3398	889.2783	927.7727	935.3066	911.0796	877.6525	849.7685	834.1817	785.8525	741.3548	721.6935	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.7502	28.8096	28.8681	29.1460	29.1986	29.4459	29.4459	29.4922	29.3502	29.1986	29.0924	28.9822	
alpha	2.9167	2.9206	2.9245	2.9431	2.9466	2.9631	2.9631	2.9661	2.9567	2.9466	2.9395	2.9321	
util living area													
	0.9502	0.9286	0.9014	0.8463	0.7576	0.6164	0.4774	0.5075	0.6850	0.8501	0.9263	0.9551	(86)
MIT	18.9138	19.1949	19.5622	20.0539	20.4873	20.8064	20.9333	20.9181	20.7183	20.1766	19.4763	18.8654	(87)
Th 2	20.0850	20.0868	20.0884	20.0964	20.0978	20.1047	20.1047	20.1060	20.1021	20.0978	20.0948	20.0917	(88)
util rest of house													
	0.9433	0.9189	0.8875	0.8234	0.7190	0.5532	0.3925	0.4236	0.6275	0.8235	0.9147	0.9488	(89)
MIT 2	17.6419	17.9958	18.4572	19.0696	19.5881	19.9456	20.0643	20.0538	19.8559	19.2286	18.3601	17.5851	(90)
Living area fraction									fLA = Living area / (4) =			0.2211	(91)
MIT	17.9231	18.2609	18.7015	19.2872	19.7869	20.1359	20.2564	20.2449	20.0466	19.4382	18.6069	17.8681	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9231	18.2609	18.7015	19.2872	19.7869	20.1359	20.2564	20.2449	20.0466	19.4382	18.6069	17.8681	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9214	0.8941	0.8614	0.7994	0.7042	0.5556	0.4075	0.4373	0.6236	0.8006	0.8902	0.9281	(94)
Useful gains	692.4367	759.3830	766.0058	741.6934	658.6483	506.1743	357.6444	371.6245	520.1730	629.1320	659.9584	669.7879	(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													
	1433.4678	1402.9761	1278.6402	1078.1326	837.8603	568.7416	375.6531	394.3947	612.9271	915.7040	1196.5493	1426.6913	(97)
Space heating kWh													
	551.3271	432.4946	381.4000	242.2362	133.3337	0.0000	0.0000	0.0000	0.0000	213.2096	386.3454	563.1361	(98a)
Space heating requirement - total per year (kWh/year)												2903.4827	
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													
	551.3271	432.4946	381.4000	242.2362	133.3337	0.0000	0.0000	0.0000	0.0000	213.2096	386.3454	563.1361	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2903.4827	
Space heating per m2											(98c) / (4) =	27.5368	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.3000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	551.3271	432.4946	381.4000	242.2362	133.3337	0.0000	0.0000	0.0000	0.0000	213.2096	386.3454	563.1361	(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)													
	597.3208	468.5749	413.2177	262.4444	144.4569	0.0000	0.0000	0.0000	0.0000	230.9963	418.5758	610.1150	(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													
	252.7690	223.5314	237.6045	209.3965	203.2788	183.5101	181.4286	188.4868	190.3795	211.8710	224.7508	250.0877	(64)
Efficiency of water heater												79.8000	(216)

(217)m	85.7595	85.5138	85.1153	84.3873	83.1376	79.8000	79.8000	79.8000	79.8000	84.0739	85.2633	85.8234	(217)
Fuel for water heating, kWh/month													
	294.7416	261.3980	279.1562	248.1374	244.5088	229.9625	227.3541	236.1990	238.5709	252.0056	263.5961	291.3982	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	31.1919	25.0233	22.5307	16.5069	12.7504	10.4172	11.6314	15.1189	19.6380	25.7661	29.1027	32.0588	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.0624	-67.1014	-95.4902	-106.2144	-113.5158	-105.5376	-104.2014	-98.8690	-89.3040	-76.1828	-52.5952	-41.6277	(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	-29.1300	-61.0633	-120.9987	-181.2167	-239.1464	-240.1649	-237.3655	-201.2016	-147.7560	-87.1794	-38.8400	-23.0534	(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	3145.7018	(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	3067.0283	(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)	251.7362	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2605.8181	(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	3944.6481	(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	3145.7018	0.2100	660.5974	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3067.0283	0.2100	644.0759	(264)
Space and water heating			1304.6733	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	251.7362	0.1443	36.3333	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-998.7021	0.1348	-134.6405	
PV Unit electricity exported	-1607.1160	0.1260	-202.4586	
Total			-337.0991	(269)
Total CO2, kg/year			1015.8368	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6300	(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	3145.7018	1.1300	3554.6430	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3067.0283	1.1300	3465.7420	(278)
Space and water heating			7020.3850	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	251.7362	1.5338	386.1213	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-998.7021	1.4983	-1496.3236	
PV Unit electricity exported	-1607.1160	0.4624	-743.1675	
Total			-2239.4911	(283)
Total Primary energy kWh/year			5297.1161	(286)
Target Primary Energy Rate (TPER)			50.2400	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200	(1b)	x 2.3700	(2b)	= 124.9464	(1b) - (3b)
First floor	52.7200	(1c)	x 2.6200	(2c)	= 138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 263.0728	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1520	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		1.0000	(17)
Infiltration rate		0.2020	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1414	(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													
	0.1803	0.1768	0.1733	0.1556	0.1520	0.1344	0.1344	0.1308	0.1414	0.1520	0.1591	0.1662	(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	0.5163	0.5156	0.5150	0.5121	0.5116	0.5090	0.5090	0.5086	0.5100	0.5116	0.5127	0.5138	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10890.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		103.2880 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.9917 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8185	44.7637	44.7100	44.4577	44.4104	44.1907	44.1907	44.1500	44.2753	44.4104	44.5060	44.6058	(38)
Heat transfer coeff	97.1261	97.0713	97.0176	96.7653	96.7180	96.4982	96.4982	96.4575	96.5829	96.7180	96.8136	96.9134	(39)
Average = Sum(39)m / 12 =												96.7650	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9212	0.9206	0.9201	0.9177	0.9173	0.9152	0.9152	0.9148	0.9160	0.9173	0.9182	0.9191	(40)
HLP (average)												0.9177	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7845 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.6154	30.1608	29.5205	28.3399	27.4559	26.4757	25.9462	26.5820	27.2743	28.3232	29.5281	30.5119	(42b)

Hot water usage for other uses

43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)

Average daily hot water use (litres/day)		67.6091 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.7615	71.7379	69.5287	66.7791	64.3262	61.7770	61.2476	63.4523	65.7135	68.3314	71.1052	73.6580	(44)
Energy conte	116.8202	102.1538	106.8630	91.4173	86.5954	75.9621	74.0736	78.5672	81.0314	92.7250	101.3024	115.3307	(45)
Energy content (annual)										Total = Sum(45)m =		1122.8420	
Distribution loss (46)m = 0.15 x (45)m													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	99.2972	86.8307	90.8335	77.7047	73.6061	64.5677	62.9626	66.7821	68.8767	78.8163	86.1070	98.0311	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	99.2972	86.8307	90.8335	77.7047	73.6061	64.5677	62.9626	66.7821	68.8767	78.8163	86.1070	98.0311	(64)
									Total per year (kWh/year) = Sum(64)m =			954.4157	(64)
12Total per year (kWh/year)												954	(64)
Electric shower(s)													
	56.7845	50.5954	55.2483	52.7228	53.7121	51.2361	52.9440	53.7121	52.7228	55.2483	54.2094	56.7845	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			645.9202	(64a)
Heat gains from water heating, kWh/month													
	39.0204	34.3565	36.5205	32.6069	31.8295	28.9510	28.9766	30.1236	30.3999	33.5161	35.0791	38.7039	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	150.1195	166.2037	150.1195	155.1234	150.1195	155.1234	150.1195	150.1195	155.1234	150.1195	155.1234	150.1195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	264.8343	267.5824	260.6572	245.9141	227.3037	209.8125	198.1273	195.3792	202.3044	217.0475	235.6579	253.1491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)													
	52.4468	51.1258	49.0866	45.2873	42.7816	40.2097	38.9471	40.4887	42.2220	45.0486	48.7210	52.0214	(72)
Total internal gains													
	532.1681	549.6795	524.6308	511.0924	484.9723	469.9132	451.9614	450.7548	464.4174	476.9830	504.2699	520.0574	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.7600	0.7000	0.7700	17.6020	(74)
South	7.4700	46.7521	0.7600	0.7000	0.7700	128.7556	(78)

Solar gains	146.3577	244.5070	325.7690	395.4000	440.0371	436.8539	421.0821	386.9543	349.3186	267.4837	174.3337	125.9307	(83)
Total gains	678.5258	794.1864	850.3998	906.4925	925.0095	906.7671	873.0435	837.7091	813.7361	744.4667	678.6036	645.9881	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.1470	31.1646	31.1819	31.2632	31.2785	31.3497	31.3497	31.3629	31.3222	31.2785	31.2476	31.2154	
alpha	3.0765	3.0776	3.0788	3.0842	3.0852	3.0900	3.0900	3.0909	3.0881	3.0852	3.0832	3.0810	
util living area													
	0.9590	0.9346	0.9037	0.8418	0.7445	0.5974	0.4579	0.4919	0.6756	0.8549	0.9360	0.9642	(86)
MIT	19.0026	19.3122	19.6869	20.1605	20.5660	20.8436	20.9489	20.9348	20.7596	20.2392	19.5373	18.9312	(87)
Th 2	20.1496	20.1500	20.1504	20.1525	20.1528	20.1546	20.1546	20.1549	20.1539	20.1528	20.1521	20.1513	(88)
util rest of house													
	0.9534	0.9260	0.8905	0.8194	0.7068	0.5372	0.3793	0.4134	0.6202	0.8298	0.9261	0.9593	(89)
MIT 2	18.3142	18.6178	18.9839	19.4400	19.8156	20.0539	20.1301	20.1221	19.9891	19.5223	18.8445	18.2452	(90)
Living area fraction										fLA = Living area / (4) =		0.2211	(91)
MIT	18.4664	18.7713	19.1394	19.5992	19.9815	20.2285	20.3111	20.3018	20.1594	19.6808	18.9976	18.3968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4664	18.7713	19.1394	19.5992	19.9815	20.2285	20.3111	20.3018	20.1594	19.6808	18.9976	18.3968	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9390	0.9086	0.8719	0.8028	0.6984	0.5428	0.3944	0.4276	0.6206	0.8137	0.9091	0.9459	(94)
Useful gains	637.1324	721.5975	741.4521	727.7343	646.0614	492.1755	344.3021	358.1916	505.0020	605.7389	616.9368	611.0292	(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													
	1375.9251	1346.5070	1226.2403	1035.3154	800.9676	543.1379	358.1180	376.3576	585.2349	878.2780	1151.8516	1375.8648	(97)
Space heating kWh													
	549.6617	419.9392	360.6824	221.4584	115.2502	0.0000	0.0000	0.0000	0.0000	202.7691	385.1386	569.0377	(98a)
Space heating requirement - total per year (kWh/year)												2823.9374	
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													
	549.6617	419.9392	360.6824	221.4584	115.2502	0.0000	0.0000	0.0000	0.0000	202.7691	385.1386	569.0377	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2823.9374	
Space heating per m2											(98c) / (4) =	26.7824	(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	907.0835	714.0870	733.0774	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7865	0.8511	0.8313	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	713.4257	607.7900	609.3713	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	987.2876	951.2077	913.0133	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	197.1805	255.5027	225.9097	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	49.2951	63.8757	56.4774	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												169.6482	(107)
Energy for space heating												26.7824	(99)
Energy for space cooling												1.6090	(108)
Total												28.3914	(109)
Fabric Energy Efficiency (DFEE)												28.4	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200	(1b)	x 2.3700	(2b) =	124.9464	(1b) - (3b)
First floor	52.7200	(1c)	x 2.6200	(2c) =	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		263.0728	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1520 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4020 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2814 (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	0.3588	0.3518	0.3448	0.3096	0.3025	0.2674	0.2674	0.2603	0.2814	0.3025	0.3166	0.3307	(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	0.5644	0.5619	0.5594	0.5479	0.5458	0.5357	0.5357	0.5339	0.5396	0.5458	0.5501	0.5547	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.0000	2.1200			(26a)
TER Opening Type (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Floor 1 P/a 0.42			52.7200	0.1300	6.8536			(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1800	7.8660			(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1800	9.4500			(29a)
External Roof 1 Horz	52.7200		52.7200	0.1100	5.7992			(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7835			(33)
Party Wall 1			39.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 103.2880 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	19.9600	0.0900	1.7964
E5 Ground floor (normal)	22.1000	0.1600	3.5360
E10 Eaves (insulation at ceiling level)	11.1000	0.0600	0.6660
E12 Gable (insulation at ceiling level)	11.0000	0.0600	0.6600
E6 Intermediate floor within a dwelling	22.1000	0.0000	0.0000

P1 Party wall - Ground floor	8.0000	0.0800	0.6400	
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600	
E2 Other lintels (including other steel lintels)	10.2100	0.0500	0.5105	
E3 Sill	9.2000	0.0500	0.4600	
E4 Jamb	24.3000	0.0500	1.2150	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.4439 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 56.2274 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9960	48.7790	48.5663	47.5671	47.3801	46.5099	46.5099	46.3487	46.8451	47.3801	47.7583	48.1537	(38)
Heat transfer coeff	105.2234	105.0063	104.7936	103.7944	103.6075	102.7372	102.7372	102.5761	103.0724	103.6075	103.9857	104.3810	(39)
Average = Sum(39)m / 12 =												103.7935	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9979	0.9959	0.9939	0.9844	0.9826	0.9744	0.9744	0.9728	0.9775	0.9826	0.9862	0.9900	(40)
HLP (average)												0.9844	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7845 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.6154	30.1608	29.5205	28.3399	27.4559	26.4757	25.9462	26.5820	27.2743	28.3232	29.5281	30.5119	(42b)

Hot water usage for other uses

43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)

Average daily hot water use (litres/day) 67.6091 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.7615	71.7379	69.5287	66.7791	64.3262	61.7770	61.2476	63.4523	65.7135	68.3314	71.1052	73.6580	(44)
Energy conte	116.8202	102.1538	106.8630	91.4173	86.5954	75.9621	74.0736	78.5672	81.0314	92.7250	101.3024	115.3307	(45)
Energy content (annual)										Total = Sum(45)m =		1122.8420	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	99.2972	86.8307	90.8335	77.7047	73.6061	64.5677	62.9626	66.7821	68.8767	78.8163	86.1070	98.0311	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	99.2972	86.8307	90.8335	77.7047	73.6061	64.5677	62.9626	66.7821	68.8767	78.8163	86.1070	98.0311	(64)
									Total per year (kWh/year) = Sum(64)m =			954.4157	(64)
12Total per year (kWh/year)												954	(64)
Electric shower(s)	56.7845	50.5954	55.2483	52.7228	53.7121	51.2361	52.9440	53.7121	52.7228	55.2483	54.2094	56.7845	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							645.9202	(64a)
Heat gains from water heating, kWh/month	39.0204	34.3565	36.5205	32.6069	31.8295	28.9510	28.9766	30.1236	30.3999	33.5161	35.0791	38.7039	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	139.2251	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.1195	166.2037	150.1195	155.1234	150.1195	155.1234	150.1195	150.1195	155.1234	150.1195	155.1234	150.1195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.8343	267.5824	260.6572	245.9141	227.3037	209.8125	198.1273	195.3792	202.3044	217.0475	235.6579	253.1491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	36.9225	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)	52.4468	51.1258	49.0866	45.2873	42.7816	40.2097	38.9471	40.4887	42.2220	45.0486	48.7210	52.0214	(72)
Total internal gains	532.1681	549.6795	524.6308	511.0924	484.9723	469.9132	451.9614	450.7548	464.4174	476.9830	504.2699	520.0574	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.6300	0.7000	0.7700	14.5912	(74)
South	7.4700	46.7521	0.6300	0.7000	0.7700	106.7317	(78)

Solar gains	121.3228	202.6834	270.0454	327.7658	364.7676	362.1289	349.0549	320.7647	289.5668	221.7299	144.5135	104.3899	(83)
Total gains	653.4909	752.3629	794.6762	838.8583	849.7400	832.0420	801.0163	771.5196	753.9842	698.7129	648.7833	624.4473	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	28.7502	28.8096	28.8681	29.1460	29.1986	29.4459	29.4459	29.4922	29.3502	29.1986	29.0924	28.9822	
alpha	2.9167	2.9206	2.9245	2.9431	2.9466	2.9631	2.9631	2.9661	2.9567	2.9466	2.9395	2.9321	
util living area	0.9642	0.9456	0.9222	0.8729	0.7915	0.6542	0.5140	0.5472	0.7250	0.8802	0.9454	0.9683	(86)
MIT	18.7459	19.0403	19.4246	19.9476	20.4148	20.7717	20.9187	20.8997	20.6685	20.0700	19.3290	18.6957	(87)
Th 2	20.0850	20.0868	20.0884	20.0964	20.0978	20.1047	20.1047	20.1060	20.1021	20.0978	20.0948	20.0917	(88)
util rest of house	0.9590	0.9379	0.9107	0.8527	0.7554	0.5912	0.4253	0.4601	0.6694	0.8574	0.9363	0.9637	(89)
MIT 2	18.0167	18.3074	18.6860	19.1984	19.6390	19.9562	20.0657	20.0553	19.8725	19.3237	18.6011	17.9718	(90)
Living area fraction										fLA = Living area / (4) =		0.2211	(91)
MIT	18.1779	18.4694	18.8492	19.3640	19.8105	20.1365	20.2543	20.2420	20.0485	19.4887	18.7620	18.1318	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1779	18.4694	18.8492	19.3640	19.8105	20.1365	20.2543	20.2420	20.0485	19.4887	18.7620	18.1318	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9447	0.9204	0.8912	0.8334	0.7424	0.5936	0.4409	0.4742	0.6657	0.8389	0.9192	0.9504	(94)
Useful gains	617.3413	692.4720	708.2503	699.1036	630.8748	493.9086	353.2071	365.8404	501.9083	586.1268	596.3426	593.4545	(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	1460.2831	1424.8781	1294.1223	1086.1059	840.3057	568.8055	375.4299	394.0937	613.1246	920.9317	1212.6800	1454.2174	(97)
Space heating kWh	627.1487	492.1769	435.8887	278.6416	155.8166	0.0000	0.0000	0.0000	0.0000	249.0948	443.7629	640.4076	(98a)
Space heating requirement - total per year (kWh/year)												3322.9380	
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	627.1487	492.1769	435.8887	278.6416	155.8166	0.0000	0.0000	0.0000	0.0000	249.0948	443.7629	640.4076	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3322.9380	
Space heating per m2											(98c) / (4) =	31.5150	(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	965.7299	760.2555	779.5781	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7207	0.7945	0.7732	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	696.0219	604.0147	602.7830	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	899.9466	867.0200	835.6489	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.8258	195.6759	173.2523	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	36.7065	48.9190	43.3131	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												128.9385	(107)
Energy for space heating												31.5150	(99)
Energy for space cooling												1.2229	(108)
Total												32.7378	(109)
Fabric Energy Efficiency (TFEE)												32.7	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200	(1b)	x 2.3700	(2b)	= 124.9464	(1b) - (3b)
First floor	52.7200	(1c)	x 2.6200	(2c)	= 138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 263.0728	(5)

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2. Ventilation rate

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		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	1.0000	(17)
Infiltration rate	0.0500	(18)
Number of sides sheltered	4	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.0350	(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	0.0446	0.0437	0.0429	0.0385	0.0376	0.0332	0.0332	0.0324	0.0350	0.0376	0.0394	0.0411	(22b)

Balanced mechanical ventilation with heat recovery		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.1396	0.1387	0.1379	0.1335	0.1326	0.1282	0.1282	0.1274	0.1300	0.1326	0.1344	0.1361	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	10890.6900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	103.2880	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9917	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	52.3076	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.1214	12.0454	11.9695	11.5897	11.5137	11.1339	11.1339	11.0579	11.2858	11.5137	11.6656	11.8176	(38)
Heat transfer coeff	64.4290	64.3530	64.2771	63.8973	63.8213	63.4415	63.4415	63.3655	63.5934	63.8213	63.9732	64.1252	(39)
Average = Sum(39)m / 12 =												63.8783	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6110	0.6103	0.6096	0.6060	0.6053	0.6017	0.6017	0.6010	0.6031	0.6053	0.6067	0.6082	(40)
HLP (average)												0.6058	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7845	(42)

Hot water usage for mixer showers

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

81.7862	80.5716	78.8611	75.7073	73.3458	70.7272	69.3128	71.0113	72.8607	75.6626	78.8814	81.5097	(42b)

Hot water usage for other uses

43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)

Average daily hot water use (litres/day)	115.0524	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)

Energy content (annual) Total = Sum(45)m =	1910.6116	

Distribution loss (46)m = 0.15 x (45)m

29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)

Water storage loss:		
Store volume	250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6000	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8640	(55)

Total storage loss

26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)

If cylinder contains dedicated solar storage

26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
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)
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

247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(62)
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)
-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)
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)
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

247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(64)
								Total per year (kWh/year) = Sum(64)m =			2499.8676	(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

105.8263	93.9970	100.7841	90.7024	89.3708	82.0951	82.1056	84.4525	84.3792	92.2277	95.8077	104.9348	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

33.1594	29.4519	23.9519	18.1331	13.5547	11.4435	12.3651	16.0726	21.5726	27.3913	31.9697	34.0810	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

395.2751	399.3768	389.0406	367.0360	339.2593	313.1530	295.7124	291.6107	301.9469	323.9514	351.7282	377.8345	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	(69)
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)

Pumps, fans

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

-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)

Water heating gains (Table 5)

142.2397	139.8765	135.4625	125.9755	120.1221	114.0210	110.3570	113.5114	117.1933	123.9620	133.0662	141.0413	(72)

Total internal gains

680.8557	678.8867	658.6365	621.3262	583.1176	548.7990	528.6160	531.3762	550.8944	585.4863	626.9457	663.1383	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.7600	0.7000	0.7700	17.6020	(74)
South	7.4700	46.7521	0.7600	0.7000	0.7700	128.7556	(78)

Solar gains	146.3577	244.5070	325.7690	395.4000	440.0371	436.8539	421.0821	386.9543	349.3186	267.4837	174.3337	125.9307	(83)
Total gains	827.2133	923.3936	984.4055	1016.7262	1023.1547	985.6529	949.6982	918.3305	900.2130	852.9700	801.2794	789.0690	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.9539	47.0093	47.0649	47.3446	47.4010	47.6847	47.6847	47.7419	47.5708	47.4010	47.2884	47.1764	
alpha	4.1303	4.1340	4.1377	4.1563	4.1601	4.1790	4.1790	4.1828	4.1714	4.1601	4.1526	4.1451	
util living area													
	0.8946	0.8486	0.7827	0.6833	0.5532	0.4059	0.2927	0.3156	0.4747	0.6944	0.8455	0.9078	(86)
Living	20.3403	20.4855	20.6440	20.7888	20.8777	20.9157	20.9240	20.9233	20.9058	20.8010	20.5562	20.2962	
Non living	19.6385	19.8167	20.0090	20.1825	20.2827	20.3249	20.3323	20.3324	20.3145	20.2000	19.9092	19.5864	
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	20.6625	20.4855	20.6440	20.7888	20.8777	20.9157	20.9240	20.9233	20.9058	20.8010	20.5562	20.3946	(87)
Th 2	20.4201	20.4207	20.4214	20.4246	20.4252	20.4285	20.4285	20.4291	20.4272	20.4252	20.4240	20.4227	(88)
util rest of house													
	0.8846	0.8355	0.7652	0.6598	0.5236	0.3712	0.2551	0.2771	0.4382	0.6671	0.8300	0.8988	(89)
MIT 2	20.1085	19.8167	20.0090	20.1825	20.2827	20.3249	20.3323	20.3324	20.3145	20.2000	19.9092	19.7371	(90)
Living area fraction									fLA = Living area / (4) =			0.2211	(91)
MIT	20.2309	19.9646	20.1494	20.3165	20.4142	20.4556	20.4631	20.4630	20.4453	20.3328	20.0522	19.8825	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2309	19.9646	20.1494	20.3165	20.4142	20.4556	20.4631	20.4630	20.4453	20.3328	20.0522	19.8825	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8811	0.8243	0.7564	0.6552	0.5230	0.3729	0.2574	0.2794	0.4394	0.6625	0.8192	0.8895	(94)
Useful gains	728.8448	761.1550	744.6396	666.2088	535.1476	367.5376	244.4459	256.5469	395.5577	565.1264	656.3978	701.8382	(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													
	1026.4150	969.4513	877.3413	729.4832	556.1520	371.4849	245.0793	257.4553	403.5165	621.1626	828.5960	1005.6410	(97)
Space heating kWh													
	221.3922	139.9751	98.7301	45.5576	15.6273	0.0000	0.0000	0.0000	0.0000	41.6910	123.9827	226.0292	(98a)
Space heating requirement - total per year (kWh/year)												912.9852	
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													
	221.3922	139.9751	98.7301	45.5576	15.6273	0.0000	0.0000	0.0000	0.0000	41.6910	123.9827	226.0292	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												912.9852	
Space heating per m2											(98c) / (4) =	8.6588	(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 %)	402.1577	(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												

	221.3922	139.9751	98.7301	45.5576	15.6273	0.0000	0.0000	0.0000	0.0000	41.6910	123.9827	226.0292 (98)
Space heating efficiency (main heating system 1)												
	402.1577	402.1577	402.1577	402.1577	402.1577	0.0000	0.0000	0.0000	0.0000	402.1577	402.1577	402.1577 (210)
Space heating fuel (main heating system)												
	55.0511	34.8060	24.5501	11.3283	3.8859	0.0000	0.0000	0.0000	0.0000	10.3668	30.8294	56.2041 (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												
	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273 (64)
Efficiency of water heater												204.6600 (216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600 (217)
Fuel for water heating, kWh/month												
	121.1319	107.0758	113.7223	100.0161	96.9503	87.3676	86.2739	89.7227	90.7241	101.1485	107.5184	119.8218 (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	15.5920	14.0831	15.5920	15.0890	15.5920	15.0890	15.5920	15.5920	15.0890	15.5920	15.0890	15.5920 (231)
Lighting	29.0242	23.2843	20.9649	15.3598	11.8644	9.6933	10.8231	14.0682	18.2732	23.9755	27.0802	29.8309 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-47.2897	-68.5321	-101.1630	-116.1436	-127.4422	-119.4908	-117.9723	-110.4190	-96.5315	-79.0063	-52.4465	-40.6640 (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	-20.3271	-44.3009	-91.0045	-141.3987	-190.7296	-193.3227	-190.7072	-159.2758	-114.6937	-65.2357	-27.7568	-15.9197 (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	227.0217 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	204.6600
Water heating fuel used	1221.4734 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)	
mechanical ventilation fans (SFP = 0.5720)	183.5827 (230a)
Total electricity for the above, kWh/year	183.5827 (231)
Electricity for lighting (calculated in Appendix L)	234.2419 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2331.7732 (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	-465.4534 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	227.0217	16.4900	37.4359	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1221.4734	16.4900	201.4210	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	183.5827	16.4900	30.2728	(249)
Energy for lighting	234.2419	16.4900	38.6265	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.1008	16.4900	-177.6139	
PV Unit electricity exported	-1254.6724	5.5900	-70.1362	
Total			-247.7501	(252)
Total energy cost			60.0060	(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] =	0.1436 (257)
SAP value		97.6724
SAP rating (Section 12)		98 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	227.0217	0.1571	35.6577	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1221.4734	0.1409	172.0761	(264)
Space and water heating			207.7338	(265)
Pumps, fans and electric keep-hot	183.5827	0.1387	25.4652	(267)
Energy for lighting	234.2419	0.1443	33.8083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1077.1008	0.1341	-144.4523	

PV Unit electricity exported	-1254.6724	0.1250	-156.8610
Total			-301.3133 (269)
Total CO2, kg/year			-34.3059 (272)
CO2 emissions per m2			-0.3300 (273)
EI value			100.3056
EI rating			100 (274)
EI band			A

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200 (1b)	x	2.3700 (2b)	=	124.9464	(1b) - (3b)
First floor	52.7200 (1c)	x	2.6200 (2c)	=	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	263.0728	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		1.0000	(17)
Infiltration rate		0.0500	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0350	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000	(22)
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250	(22a)
Adj infilt rate	0.0577	0.0542	0.0534	0.0490	0.0481	0.0411	0.0402	0.0394	0.0437	0.0507	0.0525	0.0569	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.1527	0.1492	0.1484	0.1440	0.1431	0.1361	0.1352	0.1344	0.1387	0.1457	0.1475	0.1519	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10890.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		103.2880 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.9917 (36)

Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	52.3076	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.2608	12.9570	12.8810	12.5012	12.4253	11.8176	11.7416	11.6656	12.0454	12.6531	12.8051	13.1849	(38)
Heat transfer coeff													
	65.5684	65.2646	65.1886	64.8088	64.7329	64.1252	64.0492	63.9732	64.3530	64.9607	65.1127	65.4925	(39)
Average = Sum(39)m / 12 =												64.8025	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6219	0.6190	0.6183	0.6147	0.6139	0.6082	0.6074	0.6067	0.6103	0.6161	0.6175	0.6211	(40)
HLP (average)												0.6146	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7845	(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													
	81.7862	80.5716	78.8611	75.7073	73.3458	70.7272	69.3128	71.0113	72.8607	75.6626	78.8814	81.5097	(42b)
Hot water usage for other uses													
	43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)
Average daily hot water use (litres/day)												115.0524	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
Energy conte	197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)
Energy content (annual)										Total = Sum(45)m =		1910.6116	
Distribution loss (46)m = 0.15 x (45)m													
	29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(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													
	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.8676	(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													
	105.8263	93.9970	100.7841	90.7024	89.3708	82.0951	82.1056	84.4525	84.3792	92.2277	95.8077	104.9348	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.1594	29.4519	23.9519	18.1331	13.5547	11.4435	12.3651	16.0726	21.5726	27.3913	31.9697	34.0810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	395.2751	399.3768	389.0406	367.0360	339.2593	313.1530	295.7124	291.6107	301.9469	323.9514	351.7282	377.8345	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)													
	142.2397	139.8765	135.4625	125.9755	120.1221	114.0210	110.3570	113.5114	117.1933	123.9620	133.0662	141.0413	(72)
Total internal gains													
	680.8557	678.8867	658.6365	621.3262	583.1176	548.7990	528.6160	531.3762	550.8944	585.4863	626.9457	663.1383	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	14.5262	0.7600	0.7000	0.7700	24.0459	(74)
South	7.4700	60.1191	0.7600	0.7000	0.7700	165.5686	(78)

Solar gains	189.6145	272.5384	359.8224	452.2009	482.7276	525.6728	456.5921	447.6213	406.4914	307.6476	216.4358	158.3652	(83)
Total gains	870.4702	951.4251	1018.4588	1073.5271	1065.8452	1074.4719	985.2082	978.9975	957.3857	893.1339	843.3815	821.5035	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.1379	46.3527	46.4067	46.6787	46.7335	47.1764	47.2323	47.2884	47.0093	46.5695	46.4609	46.1914	
alpha	4.0759	4.0902	4.0938	4.1119	4.1156	4.1451	4.1488	4.1526	4.1340	4.1046	4.0974	4.0794	

util living area													
	0.8237	0.7778	0.7202	0.6340	0.5250	0.3832	0.3103	0.3055	0.4102	0.5879	0.7415	0.8287	(86)
Living	20.5759	20.6571	20.7381	20.8237	20.8849	20.9166	20.9226	20.9229	20.9143	20.8665	20.7442	20.5830	
Non living	19.9199	20.0180	20.1133	20.2143	20.2823	20.3196	20.3257	20.3266	20.3158	20.2625	20.1246	19.9304	
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	20.7831	20.6571	20.7381	20.8237	20.8849	20.9166	20.9226	20.9229	20.9143	20.8665	20.7442	20.6414	(87)
Th 2	20.4104	20.4130	20.4136	20.4168	20.4175	20.4227	20.4233	20.4240	20.4207	20.4155	20.4142	20.4110	(88)
util rest of house													
	0.8070	0.7588	0.6985	0.6087	0.4949	0.3504	0.2736	0.2686	0.3736	0.5547	0.7168	0.8115	(89)
MIT 2	20.2148	20.0180	20.1133	20.2143	20.2823	20.3196	20.3257	20.3266	20.3158	20.2625	20.1246	20.0170	(90)
Living area fraction										fLA = Living area / (4) =		0.2211	(91)
MIT	20.3404	20.1593	20.2514	20.3491	20.4156	20.4516	20.4577	20.4584	20.4481	20.3960	20.2616	20.1550	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3404	20.1593	20.2514	20.3491	20.4156	20.4516	20.4577	20.4584	20.4481	20.3960	20.2616	20.1550	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8049	0.7502	0.6922	0.6057	0.4948	0.3520	0.2758	0.2709	0.3753	0.5535	0.7101	0.8035	(94)
Useful gains	700.6727	713.7476	704.9923	650.2266	527.3833	378.2599	271.7417	265.1621	359.3285	494.3593	598.8714	660.0750	(95)
Ext temp.	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000	(96)
Heat loss rate W	874.7119	839.2576	792.1363	696.6343	544.7628	381.6472	272.6992	266.0291	363.4715	519.4287	681.1832	822.2586	(97)
Space heating kWh	129.4851	84.3428	64.8352	33.4135	12.9303	0.0000	0.0000	0.0000	0.0000	18.6516	59.2645	120.6646	(98a)
Space heating requirement - total per year (kWh/year)												523.5876	
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	129.4851	84.3428	64.8352	33.4135	12.9303	0.0000	0.0000	0.0000	0.0000	18.6516	59.2645	120.6646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												523.5876	
Space heating per m2											(98c) / (4) =	4.9657	(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 %)												402.3557	(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	129.4851	84.3428	64.8352	33.4135	12.9303	0.0000	0.0000	0.0000	0.0000	18.6516	59.2645	120.6646	(98)
Space heating efficiency (main heating system 1)	402.3557	402.3557	402.3557	402.3557	402.3557	0.0000	0.0000	0.0000	0.0000	402.3557	402.3557	402.3557	(210)
Space heating fuel (main heating system)	32.1818	20.9622	16.1139	8.3045	3.2136	0.0000	0.0000	0.0000	0.0000	4.6356	14.7294	29.9895	(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	247.9086	219.1413	232.7441	204.6929	198.4184	178.8065	176.5682	183.6264	185.6759	207.0106	220.0472	245.2273	(64)
Efficiency of water heater												204.6600	(216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(217)
Fuel for water heating, kWh/month	121.1319	107.0758	113.7223	100.0161	96.9503	87.3676	86.2739	89.7227	90.7241	101.1485	107.5184	119.8218	(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	15.5920	14.0831	15.5920	15.0890	15.5920	15.0890	15.5920	15.5920	15.0890	15.5920	15.0890	15.5920	(231)
Lighting	29.0242	23.2843	20.9649	15.3598	11.8644	9.6933	10.8231	14.0682	18.2732	23.9755	27.0802	29.8309	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-59.6639	-76.0624	-110.3742	-127.3049	-134.9144	-131.5015	-123.7712	-120.7694	-107.7740	-89.1027	-63.4439	-50.2383	(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	-31.7396	-55.4622	-111.0028	-176.4336	-220.7554	-250.0120	-216.2535	-199.3124	-147.6534	-84.3774	-40.5468	-23.9262	(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												130.1305	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												204.6600	
Water heating fuel used												1221.4734	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												183.5827	(230a)
Total electricity for the above, kWh/year												183.5827	(231)
Electricity for lighting (calculated in Appendix L)												234.2419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2752.3957	(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	-982.9671	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	130.1305	25.1600	32.7408	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1221.4734	25.1600	307.3227	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	183.5827	25.1600	46.1894	(249)
Energy for lighting	234.2419	25.1600	58.9353	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1194.9207	25.1600	-300.6420	
PV Unit electricity exported	-1557.4750	5.8100	-90.4893	
Total			-391.1313	(252)
Total energy cost			54.0569	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	130.1305	0.1569	20.4196	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1221.4734	0.1409	172.0761	(264)
Space and water heating			192.4957	(265)
Pumps, fans and electric keep-hot	183.5827	0.1387	25.4652	(267)
Energy for lighting	234.2419	0.1443	33.8083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1194.9207	0.1346	-160.8760	
PV Unit electricity exported	-1557.4750	0.1259	-196.0405	
Total			-356.9165	(269)
Total CO2, kg/year			-105.1472	(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	130.1305	1.5809	205.7227	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1221.4734	1.5209	1857.7469	(278)
Space and water heating			2063.4696	(279)
Pumps, fans and electric keep-hot	183.5827	1.5128	277.7239	(281)
Energy for lighting	234.2419	1.5338	359.2881	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1194.9207	1.4976	-1789.4708	
PV Unit electricity exported	-1557.4750	0.4620	-719.6188	
Total			-2509.0896	(283)
Total Primary energy kWh/year			191.3920	(286)

SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.4	-£ 72	-41 kg (39.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£72	0.39 kg/m²	A 99	A 101
Total Savings	£72	0.39 kg/m²		

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

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

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

	Current	Potential	Saving
Electricity	£445	£362	£83
Space heating	£79	£99	-£20
Water heating	£307	£204	£103
Lighting	£59	£59	£0
Generated (PV)	-£391	-£380	-£11
Total cost of fuels	£54	-£18	£72
Total cost of uses	£54	-£18	£72

Delivered energy	-9 kWh/m²	-12 kWh/m²	3 kWh/m²
Carbon dioxide emissions	-0.1 tonnes	-0.1 tonnes	0.0 tonnes
CO2 emissions per m²	-1 kg/m²	-1 kg/m²	0 kg/m²
Primary energy	2 kWh/m²	-2 kWh/m²	4 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200 (1b)	x	2.3700 (2b)	=	124.9464	(1b) - (3b)
First floor	52.7200 (1c)	x	2.6200 (2c)	=	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	263.0728	(5)

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2. Ventilation rate

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		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		1.0000	(17)
Infiltration rate		0.0500	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0350	(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	0.0446	0.0437	0.0429	0.0385	0.0376	0.0332	0.0332	0.0324	0.0350	0.0376	0.0394	0.0411	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

Effective ac	0.1396	0.1387	0.1379	0.1335	0.1326	0.1282	0.1282	0.1274	0.1300	0.1326	0.1344	0.1361	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10890.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		103.2880 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.9917 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	12.1214	12.0454	11.9695	11.5897	11.5137	11.1339	11.1339	11.0579	11.2858	11.5137	11.6656	11.8176	(38)
Heat transfer coeff	64.4290	64.3530	64.2771	63.8973	63.8213	63.4415	63.4415	63.3655	63.5934	63.8213	63.9732	64.1252	(39)
Average = Sum(39)m / 12 =												63.8783	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6110	0.6103	0.6096	0.6060	0.6053	0.6017	0.6017	0.6010	0.6031	0.6053	0.6067	0.6082	(40)
HLP (average)												0.6058	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7845	(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	81.7862 80.5716 78.8611 75.7073 73.3458 70.7272 69.3128 71.0113 72.8607 75.6626 78.8814 81.5097	(42b)
Hot water usage for other uses	43.1461 41.5771 40.0082 38.4392 36.8703 35.3013 35.3013 36.8703 38.4392 40.0082 41.5771 43.1461	(42c)
Average daily hot water use (litres/day)	115.0524	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
Energy conte	197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)
Energy content (annual)										Total = Sum(45)m =		1910.6116	
Distribution loss (46)m = 0.15 x (45)m	29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	247.9086	219.1413	231.3483	197.9393	185.6241	166.1998	163.5412	171.5299	180.2731	205.6149	220.0472	245.2273	(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												608.8558	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												608.8558	

Solar input	-0.0000	-16.2305	-57.6796	-78.7121	-101.9309	-93.8128	-93.0888	-81.8486	-56.9681	-28.5844	-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	247.9086	202.9109	173.6687	119.2272	83.6932	72.3870	70.4524	89.6814	123.3050	177.0304	220.0472	245.2273	(64)
									Total per year (kWh/year) = Sum(64)m =			1825.5393	(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	105.8263	93.9970	99.6675	85.2995	79.1354	72.0097	71.6841	74.7753	80.0569	91.1111	95.8077	104.9348	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.1594	29.4519	23.9519	18.1331	13.5547	11.4435	12.3651	16.0726	21.5726	27.3913	31.9697	34.0810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.2751	399.3768	389.0406	367.0360	339.2593	313.1530	295.7124	291.6107	301.9469	323.9514	351.7282	377.8345	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)	142.2397	139.8765	133.9617	118.4715	106.3647	100.0135	96.3495	100.5044	111.1901	122.4612	133.0662	141.0413	(72)
Total internal gains	680.8557	678.8867	657.1357	613.8222	569.3603	534.7915	514.6086	518.3693	544.8912	583.9855	626.9457	663.1383	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.7600	0.7000	0.7700	17.6020	(74)
South	7.4700	46.7521	0.7600	0.7000	0.7700	128.7556	(78)

Solar gains	146.3577	244.5070	325.7690	395.4000	440.0371	436.8539	421.0821	386.9543	349.3186	267.4837	174.3337	125.9307	(83)
Total gains	827.2133	923.3936	982.9047	1009.2222	1009.3974	971.6455	935.6907	905.3236	894.2098	851.4692	801.2794	789.0690	(84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.9539	47.0093	47.0649	47.3446	47.4010	47.6847	47.6847	47.7419	47.5708	47.4010	47.2884	47.1764	
alpha	4.1303	4.1340	4.1377	4.1563	4.1601	4.1790	4.1790	4.1828	4.1714	4.1601	4.1526	4.1451	
util living area	0.8946	0.8486	0.7834	0.6868	0.5596	0.4115	0.2970	0.3201	0.4775	0.6952	0.8455	0.9078	(86)
Living	20.3403	20.4855	20.6430	20.7861	20.8756	20.9152	20.9239	20.9231	20.9054	20.8005	20.5562	20.2962	
Non living	19.6385	19.8167	20.0079	20.1795	20.2806	20.3245	20.3322	20.3323	20.3141	20.1993	19.9092	19.5864	
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	20.6625	20.4855	20.6430	20.7861	20.8756	20.9152	20.9239	20.9231	20.9054	20.8005	20.5562	20.3946	(87)
Th 2	20.4201	20.4207	20.4214	20.4246	20.4252	20.4285	20.4285	20.4291	20.4272	20.4252	20.4240	20.4227	(88)
util rest of house	0.8846	0.8355	0.7658	0.6634	0.5298	0.3764	0.2589	0.2810	0.4410	0.6680	0.8300	0.8988	(89)
MIT 2	20.1085	19.8167	20.0079	20.1795	20.2806	20.3245	20.3322	20.3323	20.3141	20.1993	19.9092	19.7371	(90)
Living area fraction									fLA = Living area / (4) =			0.2211	(91)
MIT	20.2309	19.9646	20.1483	20.3136	20.4121	20.4551	20.4630	20.4629	20.4448	20.3322	20.0522	19.8825	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2309	19.9646	20.1483	20.3136	20.4121	20.4551	20.4630	20.4629	20.4448	20.3322	20.0522	19.8825	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8811	0.8243	0.7571	0.6587	0.5291	0.3780	0.2612	0.2833	0.4421	0.6634	0.8192	0.8895	(94)
Useful gains	728.8448	761.1550	744.1372	664.7833	534.1091	367.3001	244.4032	256.4889	395.3481	564.8309	656.3978	701.8382	(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	1026.4150	969.4513	877.2730	729.2960	556.0191	371.4547	245.0737	257.4477	403.4898	621.1237	828.5960	1005.6410	(97)
Space heating kWh	221.3922	139.9751	99.0531	46.4491	16.3011	0.0000	0.0000	0.0000	0.0000	41.8818	123.9827	226.0292	(98a)
Space heating requirement - total per year (kWh/year)												915.0643	
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	221.3922	139.9751	99.0531	46.4491	16.3011	0.0000	0.0000	0.0000	0.0000	41.8818	123.9827	226.0292	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												915.0643	
Space heating per m2											(98c) / (4) =	8.6785	(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 %) 402.1577 (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	221.3922	139.9751	99.0531	46.4491	16.3011	0.0000	0.0000	0.0000	0.0000	41.8818	123.9827	226.0292	(98)
Space heating efficiency (main heating system 1)	402.1577	402.1577	402.1577	402.1577	402.1577	0.0000	0.0000	0.0000	0.0000	402.1577	402.1577	402.1577	(210)
Space heating fuel (main heating system)	55.0511	34.8060	24.6304	11.5500	4.0534	0.0000	0.0000	0.0000	0.0000	10.4143	30.8294	56.2041	(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	247.9086	202.9109	173.6687	119.2272	83.6932	72.3870	70.4524	89.6814	123.3050	177.0304	220.0472	245.2273	(64)
Efficiency of water heater												204.6600	(216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(217)
Fuel for water heating, kWh/month	121.1319	99.1454	84.8572	58.2562	40.8938	35.3694	34.4241	43.8197	60.2487	86.4998	107.5184	119.8218	(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	22.3865	20.2200	22.3865	21.6643	22.3865	21.6643	22.3865	22.3865	21.6643	22.3865	21.6643	22.3865	(231)
Lighting	29.0242	23.2843	20.9649	15.3598	11.8644	9.6933	10.8231	14.0682	18.2732	23.9755	27.0802	29.8309	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.3988	-68.4644	-99.6096	-112.0570	-119.6031	-111.4505	-110.0031	-104.5167	-93.8625	-78.5387	-52.6107	-40.7527	(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	-20.2179	-44.3685	-92.5578	-145.4852	-198.5686	-201.3630	-198.6765	-165.1782	-117.3627	-65.7033	-27.5925	-15.8310	(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												227.5387	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												204.6600	

Water heating fuel used	891.9864	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)		
mechanical ventilation fans (SFP = 0.5720)	183.5827	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	263.5827	(231)
Electricity for lighting (calculated in Appendix L)	234.2419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2331.7732	(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	-714.4235	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	227.5387	16.4900	37.5211	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	891.9864	16.4900	147.0886	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	183.5827	16.4900	30.2728	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	234.2419	16.4900	38.6265	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1038.8679	16.4900	-171.3093	
PV Unit electricity exported	-1292.9053	5.5900	-72.2734	
Total			-243.5827	(252)
Total energy cost			23.1182	(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] =	0.0553	(257)
SAP value	99.1032	
SAP rating (Section 12)	99	(258)
SAP band	A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	227.5387	0.1570	35.7303	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	891.9864	0.1459	130.1733	(264)
Space and water heating			165.9036	(265)
Pumps, fans and electric keep-hot	263.5827	0.1387	36.5622	(267)
Energy for lighting	234.2419	0.1443	33.8083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1038.8679	0.1345	-139.7420	
PV Unit electricity exported	-1292.9053	0.1247	-161.2080	
Total			-300.9500	(269)
Total CO2, kg/year			-64.6759	(272)
CO2 emissions per m2			-0.6100	(273)
EI value			100.5761	
EI rating			101	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.7200	(1b)	x 2.3700	(2b) =	124.9464	(1b) - (3b)
First floor	52.7200	(1c)	x 2.6200	(2c) =	138.1264	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 105.4400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		263.0728	(5)

2. Ventilation rate

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

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		1.0000 (17)
Infiltration rate		0.0500 (18)
Number of sides sheltered		4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0350 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	6.6000	6.2000	6.1000	5.6000	5.5000	4.7000	4.6000	4.5000	5.0000	5.8000	6.0000	6.5000	(22)
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250	(22a)
Adj infilt rate	0.0577	0.0542	0.0534	0.0490	0.0481	0.0411	0.0402	0.0394	0.0437	0.0507	0.0525	0.0569	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	81.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.1527	0.1492	0.1484	0.1440	0.1431	0.1361	0.1352	0.1344	0.1387	0.1457	0.1475	0.1519	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			11.9600	1.1450	13.6947			(27)
Door			2.1200	1.0000	2.1200			(26a)
Floor 1 P/a 0.42			52.7200	0.1200	6.3264	110.0000	5799.2000	(28a)
External Wall 1 Stone	52.3800	8.6800	43.7000	0.1500	6.5550	9.0000	393.3000	(29a)
External Wall 2 clad	57.9000	5.4000	52.5000	0.1500	7.8750	9.0000	472.5000	(29a)
External Roof 1 Horz	52.7200		52.7200	0.0900	4.7448	9.0000	474.4800	(30)
Total net area of external elements Aum(A, m2)			215.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3159			(33)
Party Wall 1			39.9200	0.0000	0.0000	20.0000	798.4000	(32)
Internal Wall 1 GF			50.0100			9.0000	450.0900	(32c)
Internal Wall 2 FF			119.9200			9.0000	1079.2800	(32c)
Internal Floor 1			52.7200			18.0000	948.9600	(32d)
Internal Ceiling 1			52.7200			9.0000	474.4800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 10890.6900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	103.2880 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	22.1000	0.0210	0.4641
E10 Eaves (insulation at ceiling level)	11.1000	0.0440	0.4884
E12 Gable (insulation at ceiling level)	11.0000	0.0510	0.5610
E6 Intermediate floor within a dwelling	22.1000	0.0800	1.7680
P1 Party wall - Ground floor	8.0000	0.1490	1.1920
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.4800	3.8400
E2 Other lintels (including other steel lintels)	10.2100	0.0840	0.8576
E3 Sill	9.2000	0.0430	0.3956
E4 Jamb	24.3000	0.0340	0.8262

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.9917 (36)
Point Thermal bridges	(36a) = 0.0000
Total fabric heat loss	(33) + (36) + (36a) = 52.3076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.2608	12.9570	12.8810	12.5012	12.4253	11.8176	11.7416	11.6656	12.0454	12.6531	12.8051	13.1849	(38)
Heat transfer coeff	65.5684	65.2646	65.1886	64.8088	64.7329	64.1252	64.0492	63.9732	64.3530	64.9607	65.1127	65.4925	(39)
Average = Sum(39)m / 12 =												64.8025	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6219	0.6190	0.6183	0.6147	0.6139	0.6082	0.6074	0.6067	0.6103	0.6161	0.6175	0.6211	(40)
HLP (average)												0.6146	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7845 (42)

	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	81.7862	80.5716	78.8611	75.7073	73.3458	70.7272	69.3128	71.0113	72.8607	75.6626	78.8814	81.5097	(42b)
Hot water usage for other uses	43.1461	41.5771	40.0082	38.4392	36.8703	35.3013	35.3013	36.8703	38.4392	40.0082	41.5771	43.1461	(42c)
Average daily hot water use (litres/day)												115.0524	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.9323	122.1487	118.8693	114.1466	110.2161	106.0286	104.6142	107.8816	111.2999	115.6708	120.4585	124.6558	(44)
Energy conte	197.8622	173.9381	182.6977	156.2609	148.3720	130.3745	126.5218	133.5800	137.2439	156.9642	171.6152	195.1809	(45)
Energy content (annual)										Total = Sum(45)m =		1910.6116	
Distribution loss (46)m = 0.15 x (45)m	29.6793	26.0907	27.4047	23.4391	22.2558	19.5562	18.9783	20.0370	20.5866	23.5446	25.7423	29.2771	(46)

Water storage loss:	
Store volume	250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8640 (55)

Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.9086	219.1413	231.3483	197.9393	185.6241	166.1998	163.5412	171.5299	180.2731	205.6149	220.0472	245.2273	(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												774.0647	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												774.0647	
Solar input	-9.5153	-27.9861	-73.4158	-97.4122	-115.1141	-114.8004	-102.7382	-99.5894	-75.5671	-44.9833	-12.9427	-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													
	238.3933	191.1552	157.9325	100.5271	70.5101	51.3993	60.8030	71.9406	104.7059	160.6316	207.1045	245.2273	(64)
									Total per year (kWh/year) = Sum(64)m =			1660.3304	(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													
	105.8263	93.9970	99.6675	85.2995	79.1354	72.0097	71.6841	74.7753	80.0569	91.1111	95.8077	104.9348	(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	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	167.0701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.1594	29.4519	23.9519	18.1331	13.5547	11.4435	12.3651	16.0726	21.5726	27.3913	31.9697	34.0810	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	395.2751	399.3768	389.0406	367.0360	339.2593	313.1530	295.7124	291.6107	301.9469	323.9514	351.7282	377.8345	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	54.4915	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	-111.3801	(71)
Water heating gains (Table 5)													
	142.2397	139.8765	133.9617	118.4715	106.3647	100.0135	96.3495	100.5044	111.1901	122.4612	133.0662	141.0413	(72)
Total internal gains													
	680.8557	678.8867	657.1357	613.8222	569.3603	534.7915	514.6086	518.3693	544.8912	583.9855	626.9457	663.1383	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	14.5262	0.7600	0.7000	0.7700	24.0459	(74)
South	7.4700	60.1191	0.7600	0.7000	0.7700	165.5686	(78)

Solar gains	189.6145	272.5384	359.8224	452.2009	482.7276	525.6728	456.5921	447.6213	406.4914	307.6476	216.4358	158.3652	(83)
Total gains	870.4702	951.4251	1016.9580	1066.0231	1052.0878	1060.4644	971.2007	965.9905	951.3825	891.6331	843.3815	821.5035	(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, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.1379	46.3527	46.4067	46.6787	46.7335	47.1764	47.2323	47.2884	47.0093	46.5695	46.4609	46.1914	
alpha	4.0759	4.0902	4.0938	4.1119	4.1156	4.1451	4.1488	4.1526	4.1340	4.1046	4.0974	4.0794	
util living area													
	0.8237	0.7778	0.7209	0.6374	0.5309	0.3880	0.3147	0.3096	0.4126	0.5887	0.7415	0.8287	(86)
Living	20.5759	20.6571	20.7374	20.8217	20.8832	20.9162	20.9224	20.9228	20.9140	20.8662	20.7442	20.5830	
Non living	19.9199	20.0180	20.1126	20.2122	20.2807	20.3193	20.3256	20.3265	20.3156	20.2622	20.1246	19.9304	
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	20.7831	20.6571	20.7374	20.8217	20.8832	20.9162	20.9224	20.9228	20.9140	20.8662	20.7442	20.6414	(87)
Th 2	20.4104	20.4130	20.4136	20.4168	20.4175	20.4227	20.4233	20.4240	20.4207	20.4155	20.4142	20.4110	(88)
util rest of house													
	0.8070	0.7588	0.6992	0.6121	0.5007	0.3549	0.2775	0.2722	0.3758	0.5554	0.7168	0.8115	(89)
MIT 2	20.2148	20.0180	20.1126	20.2122	20.2807	20.3193	20.3256	20.3265	20.3156	20.2622	20.1246	20.0170	(90)
Living area fraction										fLA = Living area / (4) =		0.2211	(91)
MIT	20.3404	20.1593	20.2507	20.3469	20.4139	20.4512	20.4575	20.4583	20.4479	20.3957	20.2616	20.1550	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3404	20.1593	20.2507	20.3469	20.4139	20.4512	20.4575	20.4583	20.4479	20.3957	20.2616	20.1550	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8049	0.7502	0.6929	0.6090	0.5005	0.3565	0.2797	0.2744	0.3776	0.5543	0.7101	0.8035	(94)

Useful gains	700.6727	713.7476	704.6341	649.1757	526.5452	378.0724	271.6808	265.1104	359.2218	494.2150	598.8714	660.0750	(95)
Ext temp.	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000	(96)
Heat loss rate W	874.7119	839.2576	792.0880	696.4965	544.6549	381.6232	272.6912	266.0223	363.4577	519.4098	681.1832	822.2586	(97)
Space heating kWh	129.4851	84.3428	65.0657	34.0709	13.4736	0.0000	0.0000	0.0000	0.0000	18.7450	59.2645	120.6646	(98a)
Space heating requirement - total per year (kWh/year)												525.1122	
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	129.4851	84.3428	65.0657	34.0709	13.4736	0.0000	0.0000	0.0000	0.0000	18.7450	59.2645	120.6646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												525.1122	
Space heating per m2											(98c) / (4) =	4.9802	(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 %)												402.3557	(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													
	129.4851	84.3428	65.0657	34.0709	13.4736	0.0000	0.0000	0.0000	0.0000	18.7450	59.2645	120.6646	(98)
Space heating efficiency (main heating system 1)													
	402.3557	402.3557	402.3557	402.3557	402.3557	0.0000	0.0000	0.0000	0.0000	402.3557	402.3557	402.3557	(210)
Space heating fuel (main heating system)													
	32.1818	20.9622	16.1712	8.4679	3.3487	0.0000	0.0000	0.0000	0.0000	4.6588	14.7294	29.9895	(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													
	238.3933	191.1552	157.9325	100.5271	70.5101	51.3993	60.8030	71.9406	104.7059	160.6316	207.1045	245.2273	(64)
Efficiency of water heater												204.6600	(216)
(217)m	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	204.6600	(217)
Fuel for water heating, kWh/month													
	116.4826	93.4014	77.1683	49.1191	34.4523	25.1145	29.7093	35.1513	51.1609	78.4870	101.1944	119.8218	(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	22.3865	20.2200	22.3865	21.6643	22.3865	21.6643	22.3865	22.3865	21.6643	22.3865	21.6643	22.3865	(231)
Lighting	29.0242	23.2843	20.9649	15.3598	11.8644	9.6933	10.8231	14.0682	18.2732	23.9755	27.0802	29.8309	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-59.7184	-75.7024	-107.8225	-121.0130	-124.8726	-119.3563	-114.0131	-112.0663	-103.1828	-87.8871	-63.4531	-50.3744	(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	-31.6851	-55.8221	-113.5545	-182.7255	-230.7971	-262.1571	-226.0116	-208.0155	-152.2446	-85.5929	-40.5375	-23.7901	(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												130.5094	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												204.6600	
Water heating fuel used												811.2628	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.5720)													
mechanical ventilation fans (SFP = 0.5720)												183.5827	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												263.5827	(231)
Electricity for lighting (calculated in Appendix L)												234.2419	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2752.3957	(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												-1312.7988	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	130.5094	25.1600	32.8362	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	811.2628	25.1600	204.1137	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	183.5827	25.1600	46.1894	(249)
Pump for solar water heating	80.0000	25.1600	20.1280	(249)
Energy for lighting	234.2419	25.1600	58.9353	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1139.4621	25.1600	-286.6887	
PV Unit electricity exported	-1612.9336	5.8100	-93.7114	
Total			-380.4001	(252)

Total energy cost -18.1975 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	130.5094	0.1569	20.4727	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	811.2628	0.1470	119.2849	(264)
Space and water heating			139.7577	(265)
Pumps, fans and electric keep-hot	263.5827	0.1387	36.5622	(267)
Energy for lighting	234.2419	0.1443	33.8083	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1139.4621	0.1351	-153.9944	
PV Unit electricity exported	-1612.9336	0.1255	-202.4417	
Total			-356.4361	(269)
Total CO2, kg/year			-146.3079	(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	130.5094	1.5807	206.2982	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	811.2628	1.5440	1252.5566	(278)
Space and water heating			1458.8548	(279)
Pumps, fans and electric keep-hot	263.5827	1.5128	398.7479	(281)
Energy for lighting	234.2419	1.5338	359.2881	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1139.4621	1.4995	-1708.6192	
PV Unit electricity exported	-1612.9336	0.4607	-743.0924	
Total			-2451.7116	(283)
Total Primary energy kWh/year			-234.8208	(286)