

# Full SAP Calculation Printout



Property Reference	RLT-7071-23		Issued on Date	25/10/2023	
Assessment Reference	DS SEC1 TF Scottish ACDs	Prop Type Ref	DS		
Property	Plot at, St Day Road, Redruth, Cornwall, TR15 2EH				
SAP Rating	103 A	DER	-5.47	TER	20.92
Environmental	103 A	% DER < TER			126.15
CO <sub>2</sub> Emissions (t/year)	-0.29	DFEE	45.68	TFEE	57.35
Compliance Check	See BREL	% DFEE < TFEE			20.34
% DPER < TPER	104.46	DPER	-4.95	TPER	111.01
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client					

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	89.8610 (5)

### 2. Ventilation rate

	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (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	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (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	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)

### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			7.0500	1.1450	8.0725		(27)
Door			2.1000	0.5500	1.1550		(26a)
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			121.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.5942		(33)
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)
Internal Floor 1			18.4300			18.0000	331.7400 (32d)
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3149.3100 (34)

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Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.5094 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.5000	0.0380	0.7410
E5 Ground floor (normal)	17.3000	0.1540	2.6642
E6 Intermediate floor within a dwelling	17.3000	0.0650	1.1245
E15 Flat roof with parapet	17.4500	0.3000	5.2350
E2 Other lintels (including other steel lintels)	6.2000	0.0370	0.2294
E3 Sill	5.2000	0.0330	0.1716
E4 Jamb	16.5000	0.0310	0.5115

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6772 (36)  
 Point Thermal bridges 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 35.2714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	7.2124	7.1263	7.0401	6.6092	6.5230	6.0921	6.0921	6.0059	6.2644	6.5230	6.6953	6.8677 (38)
Average = Sum(39)m / 12 =	42.4839	42.3977	42.3115	41.8806	41.7944	41.3635	41.3635	41.2773	41.5359	41.7944	41.9668	42.1391 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1535	1.1512	1.1488	1.1371	1.1348	1.1231	1.1231	1.1208	1.1278	1.1348	1.1395	1.1442 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3249 (42)

Hot water usage for mixer showers 0.0000 (42a)

Hot water usage for baths 53.4511 (42b)

Hot water usage for other uses 28.1980 (42c)

Average daily hot water use (litres/day) 75.1921 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.6491	79.8299	77.6866	74.6001	72.0313	69.2946	68.3702	70.5057	72.7397	75.5963	78.7252	81.4684 (44)
Energy conte	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598 (45)
Energy content (annual)	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340 (46)

Distribution loss (46)m = 0.15 x (45)m 1248.6735

Water storage loss: 180.0000 (47)

Store volume 1.6100 (48)

a) If manufacturer declared loss factor is known (kWh/day): 0.5400 (49)

Temperature factor from Table 2b 0.8694 (55)

Enter (49) or (54) in (55)

Total storage loss 26.9514 (56)

If cylinder contains dedicated solar storage 26.9514 (57)

Primary loss 23.2624 (59)

Combi loss 0.0000 (61)

Total heat required for water heating calculated for each month 179.5260 (62)

WWHRS 0.0000 (63a)

FV diverter -0.0000 (63b)

Solar input 0.0000 (63c)

FGHRS 0.0000 (63d)

Output from w/h 179.5260 (64)

Total per year (kWh/year) = Sum(64)m = 1839.9005 (64)

Electric shower(s) 0.0000 (64a)

Heat gains from water heating, kWh/month 83.1673 (65)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

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Solar gains	80.6789	139.6229	196.8736	253.7169	293.1117	294.9190	282.6992	252.7085	216.4647	155.8865	97.0348	68.7855 (83)
Total gains	407.0139	471.8100	516.9868	563.2373	588.8859	581.1339	559.5706	530.4622	501.5308	449.7688	406.7880	389.3227 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.5915	20.6334	20.6754	20.8882	20.9312	21.1493	21.1493	21.1934	21.0615	20.9312	20.8453	20.7600
alpha	2.3728	2.3756	2.3784	2.3925	2.3954	2.4100	2.4100	2.4129	2.4041	2.3954	2.3897	2.3840
util living area	0.8653	0.8198	0.7616	0.6671	0.5503	0.4155	0.3103	0.3381	0.4965	0.6933	0.8187	0.8753 (86)
Living	18.8356	19.2064	19.6662	20.2015	20.6058	20.8575	20.9487	20.9354	20.7701	20.2507	19.4756	18.7681
Non living	17.4776	17.9327	18.4941	19.1376	19.5992	19.8709	19.9525	19.9449	19.7875	19.2135	18.2817	17.3992
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	19.8928	19.2064	19.6662	20.2015	20.6058	20.8575	20.9487	20.9354	20.7701	20.2507	19.4756	19.0803 (87)
Th 2	19.9574	19.9593	19.9612	19.9706	19.9725	19.9820	19.9820	19.9839	19.9782	19.9725	19.9687	19.9649 (88)
util rest of house	0.8505	0.8011	0.7373	0.6341	0.5061	0.3588	0.2433	0.2695	0.4384	0.6554	0.7969	0.8615 (89)
MIT 2	18.9688	17.9327	18.4941	19.1376	19.5992	19.8709	19.9525	19.9449	19.7875	19.2135	18.2817	17.8615 (90)
Living area fraction										FLA = Living area / (4) =		0.4380 (91)
MIT	19.3735	18.4905	19.0074	19.6035	20.0401	20.3029	20.3888	20.3787	20.2178	19.6678	18.8046	18.3953 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3735	18.4905	19.0074	19.6035	20.0401	20.3029	20.3888	20.3787	20.2178	19.6678	18.8046	18.3953 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8412	0.7704	0.7122	0.6214	0.5092	0.3771	0.2706	0.2967	0.4526	0.6430	0.7681	0.8363 (94)
Useful gains	342.3991	363.4613	368.1867	349.9727	299.8536	219.1647	151.3964	157.4070	226.9781	289.2222	312.4616	325.5978 (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	640.3786	576.2071	529.2086	448.2705	348.5690	235.8938	156.7180	164.2290	254.1097	378.9817	491.2047	598.1769 (97)
Space heating kWh	221.6968	142.9652	119.8003	70.7744	36.2443	0.0000	0.0000	0.0000	0.0000	66.7811	128.6950	202.7988 (98a)
Space heating requirement - total per year (kWh/year)												989.7558
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	221.6968	142.9652	119.8003	70.7744	36.2443	0.0000	0.0000	0.0000	0.0000	66.7811	128.6950	202.7988 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												989.7558
Space heating per m2										(98c) / (4) =		26.8736 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												
Fraction of space heat from main system(s)												
Efficiency of main space heating system 1 (in %)												
Efficiency of main space heating system 2 (in %)												
Efficiency of secondary/supplementary heating system, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	221.6968	142.9652	119.8003	70.7744	36.2443	0.0000	0.0000	0.0000	0.0000	66.7811	128.6950	202.7988 (98)
Space heating efficiency (main heating system 1)	232.2732	232.2732	232.2732	232.2732	232.2732	0.0000	0.0000	0.0000	0.0000	232.2732	232.2732	232.2732 (210)
Space heating fuel (main heating system)	95.4466	61.5504	51.5773	30.4703	15.6042	0.0000	0.0000	0.0000	0.0000	28.7511	55.4068	87.3105 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (64)
Efficiency of water heater (217)m	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262 (216)
Fuel for water heating, kWh/month	90.7493	80.3893	85.7395	76.1870	74.3996	67.6350	67.1810	69.5128	69.9044	77.2381	81.2595	89.8635 (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	5.3259	4.8105	5.3259	5.1541	5.3259	5.1541	5.3259	5.3259	5.1541	5.3259	5.1541	5.3259 (231)
Lighting	12.1232	9.7257	8.7569	6.4157	4.9556	4.0488	4.5207	5.8762	7.6326	10.0143	11.3112	12.4601 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-52.8497	-71.9149	-99.6980	-104.1003	-104.1545	-90.6057	-89.6977	-87.8652	-81.7631	-77.5310	-56.2591	-45.4959 (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	-35.3132	-79.2230	-166.6439	-262.9849	-356.0531	-364.0780	-358.0749	-299.2899	-214.6792	-118.2777	-49.1490	-27.6958 (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												426.1171 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												197.8262

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Water heating fuel used	930.0591 (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)	62.7086 (230a)
Total electricity for the above, kWh/year	62.7086 (231)
Electricity for lighting (calculated in Appendix L)	97.8409 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3293.3975 (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	-1776.6718 (238)

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	426.1171	0.1554	66.2224 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	930.0591	0.1406	130.7974 (264)
Space and water heating			197.0198 (265)
Pumps, fans and electric keep-hot	62.7086	0.1387	8.6985 (267)
Energy for lighting	97.8409	0.1443	14.1215 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-961.9350	0.1363	-131.1097
PV Unit electricity exported	-2331.4625	0.1245	-290.3724
Total			-421.4821 (269)
Total CO2, kg/year			-201.6424 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-5.4700 (273)

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13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	426.1171	1.5753	671.2628 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	930.0591	1.5200	1413.6882 (278)
Space and water heating			2084.9511 (279)
Pumps, fans and electric keep-hot	62.7086	1.5128	94.8656 (281)
Energy for lighting	97.8409	1.5338	150.0716 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-961.9350	1.5038	-1446.6017
PV Unit electricity exported	-2331.4625	0.4571	-1065.7379
Total			-2512.3396 (283)
Total Primary energy kWh/year			-182.4514 (286)
Dwelling Primary energy Rate (DPER)			-4.9500 (287)

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CALCULATION OF TARGET EMISSIONS  
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1. Overall dwelling characteristics  
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	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 89.8610 (5)

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2. Ventilation rate  
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	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2226 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4726 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)

# Full SAP Calculation Printout



Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.3662 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
Effective ac	0.4670	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303	(22b)
	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926	(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			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			7.0500	1.1450	8.0725			(27)
Floor 1 P/a 0.94			18.4300	0.1300	2.3959			(28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1800	6.0822			(29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1800	7.4520			(29a)
External Roof 1 Flat	18.7100		18.7100	0.1100	2.0581			(30)
Total net area of external elements Aum(A, m2)			121.4800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 28.1607			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.5094	(35)

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

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	19.5000	0.0900	1.7550	
E5 Ground floor (normal)	17.3000	0.1600	2.7680	
E6 Intermediate floor within a dwelling	17.3000	0.0000	0.0000	
E15 Flat roof with parapet	17.4500	0.5600	9.7720	
E2 Other lintels (including other steel lintels)	6.2000	0.0500	0.3100	
E3 Sill	5.2000	0.0500	0.2600	
E4 Jamb	16.5000	0.0500	0.8250	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			15.6900	(36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 43.8507 (37)

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

Point Thermal bridges

Total fabric heat loss

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	18.0601	17.9345	17.8115	17.2335	17.1253	16.6219	16.6219	16.5287	16.8158	17.1253	17.3441	17.5728	(38)
Average = Sum(39)m / 12 =	61.9108	61.7852	61.6622	61.0842	60.9761	60.4726	60.4726	60.3794	60.6665	60.9761	61.1948	61.4235	(39)
													61.0837

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6810	1.6776	1.6742	1.6585	1.6556	1.6419	1.6419	1.6394	1.6472	1.6556	1.6615	1.6678	(40)
HLP (average)													1.6585
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3249	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	53.4511	52.6573	51.5394	49.4783	47.9349	46.2235	45.2992	46.4092	47.6178	49.4490	51.5526	53.2704	53.2704	(42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980	28.1980	(42c)
Average daily hot water use (litres/day)														75.1921 (43)
Daily hot water use	81.6491	79.8299	77.6866	74.6001	72.0313	69.2946	68.3702	70.5057	72.7397	75.5963	78.7252	81.4684	81.4684	(44)
Energy conte	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598	127.5598	(45)
Energy content (annual)														Total = Sum(45)m = 1248.6735
Distribution loss (46)m = 0.15 x (45)m	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340	19.1340	(46)
Water storage loss:														180.0000 (47)
Store volume														1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):														0.5400 (49)
Temperature factor from Table 2b														0.8381 (55)
Enter (49) or (54) in (55)														
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	178.5548	158.1539	168.6441	149.7780	146.2107	132.8600	131.9305	136.5434	137.3495	151.8261	159.8127	176.8025	176.8025	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	178.5548	158.1539	168.6441	149.7780	146.2107	132.8600	131.9305	136.5434	137.3495	151.8261	159.8127	176.8025	176.8025	(64)
12Total per year (kWh/year)														Total per year (kWh/year) = Sum(64)m = 1828.4663 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1828 (64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														0.0000 (64a)
Heat gains from water heating, kWh/month	82.3904	73.3793	79.0951	72.0795	71.6360	66.4543	66.8879	68.4216	67.9470	73.5031	75.4161	81.8078	81.8078	(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	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.0264	64.2436	58.0264	59.9606	58.0264	59.9606	58.0264	58.0264	59.9606	58.0264	59.9606	58.0264	58.0264	(67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.6515	114.8308	111.8589	105.5321	97.5455	90.0393	85.0247	83.8454	86.8173	93.1442	101.1307	108.6369 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	110.7398	109.1954	106.3106	100.1104	96.2850	92.2976	89.9030	91.9646	94.3709	98.7945	104.7445	109.9567 (72)
Total internal gains	328.2908	334.1428	322.0690	311.4762	297.7300	285.1706	275.8272	276.7094	284.0219	295.8381	311.7089	322.4930 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	0.5400	11.2829	0.6300	0.7000	0.7700	1.8620 (75)						
Southeast	1.0500	36.7938	0.6300	0.7000	0.7700	11.8069 (77)						
Southwest	4.4100	36.7938	0.6300	0.7000	0.7700	49.5890 (79)						
Northwest	1.0500	11.2829	0.6300	0.7000	0.7700	3.6206 (81)						
Solar gains	66.8786	115.7401	163.1978	210.3179	242.9742	244.4723	234.3427	209.4821	179.4378	129.2217	80.4368	57.0195 (83)
Total gains	395.1694	449.8829	485.2669	521.7941	540.7041	529.6430	510.1700	486.1915	463.4597	425.0598	392.1457	379.5125 (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	14.1301	14.1589	14.1871	14.3214	14.3468	14.4662	14.4662	14.4885	14.4199	14.3468	14.2955	14.2422
alpha	1.9420	1.9439	1.9458	1.9548	1.9565	1.9644	1.9644	1.9659	1.9613	1.9565	1.9530	1.9495
util living area	0.8986	0.8703	0.8332	0.7683	0.6774	0.5552	0.4403	0.4707	0.6281	0.7827	0.8678	0.9051 (86)
MIT	17.5799	17.9574	18.5268	19.2831	19.9796	20.5256	20.7884	20.7502	20.3503	19.4681	18.4121	17.5161 (87)
Th 2	19.5545	19.5569	19.5594	19.5707	19.5728	19.5827	19.5827	19.5846	19.5789	19.5728	19.5685	19.5640 (88)
util rest of house	0.8840	0.8520	0.8086	0.7320	0.6217	0.4692	0.3225	0.3543	0.5485	0.7411	0.8460	0.8914 (89)
MIT 2	15.7627	16.2248	16.9221	17.8367	18.6473	19.2412	19.4802	19.4548	19.0743	18.0798	16.8006	15.6873 (90)
Living area fraction	fLA = Living area / (4) = 0.4380 (91)											
MIT	16.5585	16.9836	17.6249	18.4702	19.2308	19.8037	20.0531	20.0221	19.6332	18.6878	17.5064	16.4883 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.5585	16.9836	17.6249	18.4702	19.2308	19.8037	20.0531	20.0221	19.6332	18.6878	17.5064	16.4883 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8419	0.8084	0.7666	0.6984	0.6065	0.4839	0.3643	0.3931	0.5519	0.7096	0.8042	0.8501 (94)
Useful gains	332.6741	363.6893	372.0196	364.4182	327.9536	256.2763	185.8624	191.1017	255.7778	301.6202	315.3525	322.6373 (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	758.9349	746.5879	685.9831	584.5884	459.2002	314.6830	208.8206	218.7027	335.6785	493.1650	636.8153	754.7882 (97)
Space heating kWh	317.1381	257.3079	233.5888	158.5225	97.6474	0.0000	0.0000	0.0000	0.0000	142.5093	231.4532	321.5203 (98a)
Space heating requirement - total per year (kWh/year)	1759.6875											
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	317.1381	257.3079	233.5888	158.5225	97.6474	0.0000	0.0000	0.0000	0.0000	142.5093	231.4532	321.5203 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1759.6875											
Space heating per m <sup>2</sup>	(98c) / (4) = 47.7786 (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	317.1381	257.3079	233.5888	158.5225	97.6474	0.0000	0.0000	0.0000	0.0000	142.5093	231.4532	321.5203 (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)	343.5949	278.7734	253.0757	171.7471	105.7935	0.0000	0.0000	0.0000	0.0000	154.3980	250.7619	348.3426 (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	178.5548	158.1539	168.6441	149.7780	146.2107	132.8600	131.9305	136.5434	137.3495	151.8261	159.8127	176.8025 (64)
Water heating requirement	85.3333	85.1445	84.7906	84.1873	83.1756	79.8000	79.8000	79.8000	79.8000	83.9180	84.8895	79.8000 (216)
Efficiency of water heater (217)m	209.2441	185.7476	198.8949	177.9105	175.7856	166.4912	165.3265	171.1070	172.1172	180.9220	188.2597	85.3834 (217)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)

# Full SAP Calculation Printout



Lighting	12.0567	9.6724	8.7089	6.3805	4.9285	4.0266	4.4959	5.8440	7.5908	9.9595	11.2492	12.3918	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-17.8305	-25.4633	-37.0994	-42.3486	-46.2760	-43.4930	-43.0290	-40.3571	-35.6802	-29.4736	-19.7452	-15.3835	(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	-9.1107	-19.2679	-38.4582	-57.9688	-76.8079	-77.1619	-76.1825	-64.3717	-47.0569	-27.5420	-12.1670	-7.1911	(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												1906.4870	(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												2198.8751	(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)												97.3049	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-909.4661	(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												3379.2009	(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	1906.4870	0.2100	400.3623 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2198.8751	0.2100	461.7638 (264)
Space and water heating			862.1260 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	97.3049	0.1443	14.0441 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-396.1796	0.1342	-53.1868
PV Unit electricity exported	-513.2865	0.1258	-64.5787
Total			-117.7655 (269)
Total CO2, kg/year			770.3339 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			20.9200 (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	1906.4870	1.1300	2154.3303 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2198.8751	1.1300	2484.7289 (278)
Space and water heating			4639.0592 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	97.3049	1.5338	149.2494 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-396.1796	1.4961	-592.7413
PV Unit electricity exported	-513.2865	0.4618	-237.0473
Total			-829.7886 (283)
Total Primary energy kWh/year			4088.6208 (286)
Target Primary Energy Rate (TPER)			111.0100 (287)

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 89.8610 (5)

### 2. Ventilation rate

m3 per hour

# Full SAP Calculation Printout



Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000	Air changes per hour / (5) =	0.2226 (8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.3726	(18)
Number of sides sheltered			3	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2887 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3681	0.3609	0.3537	0.3176	0.3104	0.2743	0.2743	0.2671	0.2887	0.3104	0.3248	0.3393 (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	0.5678	0.5651	0.5626	0.5504	0.5482	0.5376	0.5376	0.5357	0.5417	0.5482	0.5528	0.5576 (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)			7.0500	1.1450	8.0725		(27)
Door			2.1000	0.5500	1.1550		(26a)
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)
Total net area of external elements Aum(A, m2)			121.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.5942	(33)
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)
Internal Floor 1			18.4300			18.0000	331.7400 (32d)
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3149.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		85.5094 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.5000	0.0380	0.7410
E5 Ground floor (normal)	17.3000	0.1540	2.6642
E6 Intermediate floor within a dwelling	17.3000	0.0650	1.1245
E15 Flat roof with parapet	17.4500	0.3000	5.2350
E2 Other lintels (including other steel lintels)	6.2000	0.0370	0.2294
E3 Sill	5.2000	0.0330	0.1716
E4 Jamb	16.5000	0.0310	0.5115

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6772 (36)
Point Thermal bridges		0.0000 (36a)
Total fabric heat loss	(33) + (36) + (36a) =	35.2714 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	16.8366	16.7585	16.6820	16.3228	16.2556	15.9427	15.9427	15.8847	16.0632	16.2556	16.3915	16.5337 (38)
Average = Sum(39)m / 12 =	52.1080	52.0299	51.9535	51.5942	51.5270	51.2141	51.2141	51.1561	51.3346	51.5270	51.6630	51.8051 (39)
												51.5939

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4148	1.4127	1.4106	1.4009	1.3990	1.3906	1.3906	1.3890	1.3938	1.3990	1.4027	1.4066 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3249 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	20.0910	19.7926	19.3724	18.5977	18.0176	17.3743	17.0269	17.4441	17.8984	18.5867	19.3774	20.0230	20.0230 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980	28.1980 (42c)
Average daily hot water use (litres/day)													44.2620 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	48.2889	46.9652	45.5196	43.7195	42.1140	40.4454	40.0979	41.5405	43.0202	44.7339	46.5500	48.2210	48.2210 (44)
Energy content (annual)	76.4779	66.8778	69.9620	59.8498	56.6936	49.7323	48.4950	51.4359	53.0482	60.7035	66.3190	75.5025	75.5025 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (56)
If cylinder contains dedicated solar storage													
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month													
WWHRS	65.0062	56.8461	59.4677	50.8723	48.1895	42.2725	41.2207	43.7205	45.0910	51.5980	56.3711	64.1771	64.1771 (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	0.0000 (63a)



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PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	65.0062	56.8461	59.4677	50.8723	48.1895	42.2725	41.2207	43.7205	45.0910	51.5980	56.3711	64.1771	(64)
Total per year (kWh/year) = Sum(64)m =												624.8327 (64)	
12Total per year (kWh/year)												625 (64)	
Electric shower(s)	37.1851	33.1323	36.1792	34.5253	35.1732	33.5518	34.6702	35.1732	34.5253	36.1792	35.4989	37.1851	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												422.9789 (64a)	
Heat gains from water heating, kWh/month	25.5478	22.4946	23.9117	21.3494	20.8407	18.9561	18.9727	19.7234	19.9041	21.9443	22.9675	25.3406	(65)

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

Metabolic gains (Table 5), Watts													
(66m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.0264	64.2436	58.0264	59.9606	58.0264	59.9606	58.0264	58.0264	59.9606	58.0264	59.9606	58.0264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	113.6515	114.8308	111.8589	105.5321	97.5455	90.0393	85.0247	83.8454	86.8173	93.1442	101.1307	108.6369	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	(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)													
	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	(71)
Water heating gains (Table 5)													
	34.3385	33.4741	32.1394	29.6520	28.0117	26.3279	25.5010	26.5100	27.6446	29.4950	31.8993	34.0599	(72)
Total internal gains	248.8894	255.4215	244.8978	238.0177	226.4567	219.2009	211.4252	211.2548	217.2955	223.5386	235.8637	243.5962	(73)

## 6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
			W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
Northeast		0.5400	11.2829	0.7600	0.7000	0.7700	2.2463 (75)						
Southeast		1.0500	36.7938	0.7600	0.7000	0.7700	14.2433 (77)						
Southwest		4.4100	36.7938	0.7600	0.7000	0.7700	59.8217 (79)						
Northwest		1.0500	11.2829	0.7600	0.7000	0.7700	4.3677 (81)						
Solar gains	80.6789	139.6229	196.8736	253.7169	293.1117	294.9190	282.6992	252.7085	216.4647	155.8865	97.0348	68.7855	(83)
Total gains	329.5684	395.0445	441.7714	491.7346	519.5683	514.1199	494.1243	463.9634	433.7602	379.4251	332.8985	312.3817	(84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.7884	16.8136	16.8383	16.9556	16.9777	17.0814	17.0814	17.1007	17.0413	16.9777	16.9330	16.8865	21.0000 (85)
alpha	2.1192	2.1209	2.1226	2.1304	2.1318	2.1388	2.1388	2.1400	2.1361	2.1318	2.1289	2.1258	
util living area	0.9166	0.8813	0.8358	0.7574	0.6528	0.5209	0.4055	0.4409	0.6100	0.7884	0.8852	0.9243	(86)
MIT	17.8688	18.3000	18.8799	19.6051	20.2240	20.6667	20.8611	20.8288	20.5025	19.6880	18.6565	17.7855	(87)
Th 2	19.7520	19.7536	19.7552	19.7627	19.7641	19.7706	19.7706	19.7718	19.7681	19.7641	19.7612	19.7583	(88)
util rest of house													
	0.9052	0.8657	0.8137	0.7238	0.6021	0.4460	0.3076	0.3424	0.5390	0.7515	0.8674	0.9139	(89)
MIT 2	16.9585	17.3772	17.9383	18.6300	19.1951	19.5733	19.7128	19.6959	19.4507	18.7274	17.7391	16.8813	(90)
Living area fraction													
	17.3571	17.7814	18.3507	19.0571	19.6457	20.0522	20.2157	20.1921	19.9114	19.1481	18.1409	17.2773	(91)
Temperature adjustment													
	17.3571	17.7814	18.3507	19.0571	19.6457	20.0522	20.2157	20.1921	19.9114	19.1481	18.1409	17.2773	(92)
adjusted MIT	17.3571	17.7814	18.3507	19.0571	19.6457	20.0522	20.2157	20.1921	19.9114	19.1481	18.1409	17.2773	(93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8761	0.8344	0.7836	0.7019	0.5968	0.4643	0.3447	0.3779	0.5480	0.7298	0.8376	0.8859	(94)
Useful gains	288.7428	329.6132	346.1803	345.1626	310.0917	238.6851	170.3015	175.3153	237.7123	276.9219	278.8218	276.7403	(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	680.3810	670.2172	615.6823	524.0450	409.4193	279.2283	185.1743	193.9879	298.3236	440.4582	570.4051	677.4696	(97)
Space heating kWh	291.3788	228.8859	200.5095	128.7953	73.8997	0.0000	0.0000	0.0000	0.0000	121.6711	209.9400	298.1426	(98a)
Space heating requirement - total per year (kWh/year)													
													1553.2228
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	291.3788	228.8859	200.5095	128.7953	73.8997	0.0000	0.0000	0.0000	0.0000	121.6711	209.9400	298.1426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													
													1553.2228
Space heating per m <sup>2</sup>										(98c) / (4) =			42.1728 (99)

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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	481.4125	378.9843	388.7867	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7429	0.8010	0.7765	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	357.6632	303.5799	301.9066	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	581.2740	559.0886	524.9283	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	160.9998	190.0984	165.9281	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			1.0000 (105)
Space cooling kWh	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 requirement	0.0000	0.0000	0.0000	0.0000	0.0000	40.2500	47.5246	41.4820	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												129.2566 (107)
Energy for space cooling												42.1728 (99)
Total												3.5095 (108)
Fabric Energy Efficiency (DFEE)												45.6823 (109)
												45.7 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	89.8610 (5)

2. Ventilation rate

	m3 per hour											
Number of open chimneys	0 * 80 =											0.0000 (6a)
Number of open flues	0 * 20 =											0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000 (6d)
Number of flues attached to other heater	0 * 35 =											0.0000 (6e)
Number of blocked chimneys	0 * 20 =											0.0000 (6f)
Number of intermittent extract fans	2 * 10 =											20.0000 (7a)
Number of passive vents	0 * 10 =											0.0000 (7b)
Number of flueless gas fires	0 * 40 =											0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =											0.2226 (8)
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50	5.0000											(17)
Infiltration rate	0.4726											(18)
Number of sides sheltered	3											(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3662 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.4670	0.4578	0.4486	0.4029	0.3937	0.3479	0.3479	0.3388	0.3662	0.3937	0.4120	0.4303 (22b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23b)
Effective ac	0.6090	0.6048	0.6006	0.5811	0.5775	0.5605	0.5605	0.5574	0.5671	0.5775	0.5849	0.5926 (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			2.1000	1.0000	2.1000		(26a)					
TER Opening Type (Uw = 1.20)			7.0500	1.1450	8.0725		(27)					
Floor 1 P/a 0.94			18.4300	0.1300	2.3959		(28a)					
External Wall 1 Render	39.7900	6.0000	33.7900	0.1800	6.0822		(29a)					
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1800	7.4520		(29a)					
External Roof 1 Flat	18.7100		18.7100	0.1100	2.0581		(30)					
Total net area of external elements Aum(A, m2)			121.4800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.1607	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.5094 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				19.5000	0.0900	1.7550						
E5 Ground floor (normal)				17.3000	0.1600	2.7680						
E6 Intermediate floor within a dwelling				17.3000	0.0000	0.0000						
E15 Flat roof with parapet				17.4500	0.5600	9.7720						
E2 Other lintels (including other steel lintels)				6.2000	0.0500	0.3100						
E3 Sill				5.2000	0.0500	0.2600						
E4 Jamb				16.5000	0.0500	0.8250						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.6900 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 43.8507 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.0601	17.9345	17.8115	17.2335	17.1253	16.6219	16.6219	16.5287	16.8158	17.1253	17.3441	17.5728 (38)

# Full SAP Calculation Printout



Average = Sum(39)m / 12 =	61.9108	61.7852	61.6622	61.0842	60.9761	60.4726	60.4726	60.3794	60.6665	60.9761	61.1948	61.4235 (39)
												61.0837
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6810	1.6776	1.6742	1.6585	1.6556	1.6419	1.6419	1.6394	1.6472	1.6556	1.6615	1.6678 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3249 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	20.0910	19.7926	19.3724	18.5977	18.0176	17.3743	17.0269	17.4441	17.8984	18.5867	19.3774	20.0230 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980 (42c)
Average daily hot water use (litres/day)												44.2620 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	48.2889	46.9652	45.5196	43.7195	42.1140	40.4454	40.0979	41.5405	43.0202	44.7339	46.5500	48.2210 (44)
Energy content (annual)	76.4779	66.8778	69.9620	59.8498	56.6936	49.7323	48.4950	51.4359	53.0482	60.7035	66.3190	75.5025 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	65.0062	56.8461	59.4677	50.8723	48.1895	42.2725	41.2207	43.7205	45.0910	51.5980	56.3711	64.1771 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	65.0062	56.8461	59.4677	50.8723	48.1895	42.2725	41.2207	43.7205	45.0910	51.5980	56.3711	64.1771 (64)
12Total per year (kWh/year)												624.8327 (64)
Electric shower(s)	37.1851	33.1323	36.1792	34.5253	35.1732	33.5518	34.6702	35.1732	34.5253	36.1792	35.4989	37.1851 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												422.9789 (64a)
Heat gains from water heating, kWh/month	25.5478	22.4946	23.9117	21.3494	20.8407	18.9561	18.9727	19.7234	19.9041	21.9443	22.9675	25.3406 (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	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434	66.2434 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.0264	64.2436	58.0264	59.9606	58.0264	59.9606	58.0264	58.0264	59.9606	58.0264	59.9606	58.0264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.6515	114.8308	111.8589	105.5321	97.5455	90.0393	85.0247	83.8454	86.8173	93.1442	101.1307	108.6369 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243	29.6243 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	34.3385	33.4741	32.1394	29.6520	28.0117	26.3279	25.5010	26.5100	27.6446	29.4950	31.8993	34.0599 (72)
Total internal gains	248.8894	255.4215	244.8978	238.0177	226.4567	219.2009	211.4252	211.2548	217.2955	223.5386	235.8637	243.5962 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	0.5400	11.2829	0.6300	0.7000	0.7700	0.7700	1.8620 (75)					
Southeast	1.0500	36.7938	0.6300	0.7000	0.7700	0.7700	11.8069 (77)					
Southwest	4.4100	36.7938	0.6300	0.7000	0.7700	0.7700	49.5890 (79)					
Northwest	1.0500	11.2829	0.6300	0.7000	0.7700	0.7700	3.6206 (81)					
Solar gains	66.8786	115.7401	163.1978	210.3179	242.9742	244.4723	234.3427	209.4821	179.4378	129.2217	80.4368	57.0195 (83)
Total gains	315.7680	371.1616	408.0956	448.3357	469.4308	463.6732	445.7679	420.7369	396.7333	352.7603	316.3004	300.6158 (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	14.1301	14.1589	14.1871	14.3214	14.3468	14.4662	14.4662	14.4885	14.4199	14.3468	14.2955	14.2422
alpha	1.9420	1.9439	1.9458	1.9548	1.9565	1.9644	1.9644	1.9659	1.9613	1.9565	1.9530	1.9495
util living area	0.9284	0.9024	0.8688	0.8081	0.7221	0.6014	0.4854	0.5201	0.6799	0.8289	0.9038	0.9343 (86)
MIT	17.2679	17.6719	18.2755	19.0872	19.8409	20.4478	20.7464	20.6990	20.2415	19.2636	18.1362	17.1991 (87)
Th 2	19.5545	19.5569	19.5594	19.5707	19.5728	19.5827	19.5827	19.5846	19.5789	19.5728	19.5685	19.5640 (88)
util rest of house	0.9174	0.8876	0.8481	0.7755	0.6691	0.5146	0.3609	0.3980	0.6024	0.7929	0.8867	0.9241 (89)
MIT 2	16.2557	16.6509	17.2406	18.0268	18.7296	19.2625	19.4832	19.4577	19.1029	18.2140	17.1215	16.1941 (90)

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Living area fraction									FLA = Living area / (4) =	0.4380 (91)		
MIT	16.6990	17.0981	17.6939	18.4912	19.2163	19.7816	20.0364	20.0014	19.6016	18.6736	17.5659	16.6343 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6990	17.0981	17.6939	18.4912	19.2163	19.7816	20.0364	20.0014	19.6016	18.6736	17.5659	16.6343 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8868	0.8537	0.8133	0.7453	0.6538	0.5281	0.4042	0.4374	0.6038	0.7644	0.8542	0.8948	(94)
Useful gains	280.0343	316.8769	331.8953	334.1654	306.9126	244.8689	180.1593	184.0262	239.5405	269.6432	270.1979	268.9911	(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	767.6319	753.6608	690.2374	585.8731	458.3143	313.3475	207.8104	217.4476	333.7620	492.2986	640.4587	763.7577	(97)
Space heating kWh	362.7727	293.5188	266.6066	181.2295	112.6429	0.0000	0.0000	0.0000	0.0000	165.6556	266.5878	368.1064	(98a)
Space heating requirement - total per year (kWh/year)												2017.1202	
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	362.7727	293.5188	266.6066	181.2295	112.6429	0.0000	0.0000	0.0000	0.0000	165.6556	266.5878	368.1064	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2017.1202	
Space heating per m2												(98c) / (4) =	54.7684 (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	568.4429	447.4976	458.8836	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6343	0.7003	0.6738	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	360.5482	313.3914	309.1944	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	522.3104	502.5681	474.4038	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	116.4688	140.7474	122.9158	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	29.1172	35.1869	30.7290	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												95.0330	(107)
Energy for space heating												54.7684	(99)
Energy for space cooling												2.5803	(108)
Total												57.3487	(109)
Fabric Energy Efficiency (TFEE)												57.3	(109)

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

## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)	
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	89.8610 (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  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered

Blower Door  
3.0000 (17)  
0.1500 (18)  
3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.7750 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1162 (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													

# Full SAP Calculation Printout



Balanced mechanical ventilation with heat recovery	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (22b)
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (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)			7.0500	1.1450	8.0725		(27)
Door			2.1000	0.5500	1.1550		(26a)
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)
Total net area of external elements Aum(A, m2)			121.4800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	24.5942			(33)
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)
Internal Floor 1			18.4300			18.0000	331.7400 (32d)
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3149.3100 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.5094 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.5000	0.0380	0.7410
E5 Ground floor (normal)	17.3000	0.1540	2.6642
E6 Intermediate floor within a dwelling	17.3000	0.0650	1.1245
E15 Flat roof with parapet	17.4500	0.3000	5.2350
E2 Other lintels (including other steel lintels)	6.2000	0.0370	0.2294
E3 Sill	5.2000	0.0330	0.1716
E4 Jamb	16.5000	0.0310	0.5115

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6772 (36)

Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 35.2714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	7.2124	7.1263	7.0401	6.6092	6.5230	6.0921	6.0921	6.0059	6.2644	6.5230	6.6953	6.8677 (38)
Average = Sum(39)m / 12 =	42.4839	42.3977	42.3115	41.8806	41.7944	41.3635	41.3635	41.2773	41.5359	41.7944	41.9668	42.1391 (39)
HLP	1.1535	1.1512	1.1488	1.1371	1.1348	1.1231	1.1231	1.1208	1.1278	1.1348	1.1395	1.1442 (40)
HLP (average)												1.1365
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	53.4511	52.6573	51.5394	49.4783	47.9349	46.2235	45.2992	46.4092	47.6178	49.4490	51.5526	53.2704 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980 (42c)
Average daily hot water use (litres/day)												75.1921 (43)
Daily hot water use	81.6491	79.8299	77.6866	74.6001	72.0313	69.2946	68.3702	70.5057	72.7397	75.5963	78.7252	81.4684 (44)
Energy content (annual)	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598 (45)
Distribution loss (46)m = 0.15 x (45)m	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340 (46)
Water storage loss:												180.0000 (47)
Store volume												1.6100 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8694 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (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	83.1673	74.0810	79.8720	72.8314	72.4129	67.2061	67.6648	69.1985	68.6989	74.2800	76.1679	82.5847 (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	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921 (66)

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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8504	12.3018	10.0045	7.5740	5.6617	4.7798	5.1648	6.7134	9.0107	11.4411	13.3535	14.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.6291	171.3893	166.9536	157.5105	145.5904	134.3871	126.9026	125.1424	129.5781	139.0211	150.9413	162.1446 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	111.7841	110.2396	107.3549	101.1547	97.3292	93.3418	90.9472	93.0088	95.4151	99.8387	105.7888	111.0009 (72)
Total internal gains	366.0350	364.7021	355.0844	337.0107	319.3527	303.2802	293.7861	295.6360	304.7753	321.0724	340.8550	358.1523 (73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	0.5400	11.2829	0.7600	0.7000	0.7700	2.2463 (75)						
Southeast	1.0500	36.7938	0.7600	0.7000	0.7700	14.2433 (77)						
Southwest	4.4100	36.7938	0.7600	0.7000	0.7700	59.8217 (79)						
Northwest	1.0500	11.2829	0.7600	0.7000	0.7700	4.3677 (81)						
Solar gains	80.6789	139.6229	196.8736	253.7169	293.1117	294.9190	282.6992	252.7085	216.4647	155.8865	97.0348	68.7855 (83)
Total gains	446.7139	504.3251	551.9580	590.7276	612.4643	598.1992	576.4852	548.3445	521.2400	476.9589	437.8898	426.9377 (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	20.5915	20.6334	20.6754	20.8882	20.9312	21.1493	21.1493	21.1934	21.0615	20.9312	20.8453	20.7600
alpha	2.3728	2.3756	2.3784	2.3925	2.3954	2.4100	2.4100	2.4129	2.4041	2.3954	2.3897	2.3840
util living area	0.8436	0.8012	0.7402	0.6495	0.5354	0.4057	0.3020	0.3283	0.4823	0.6721	0.7979	0.8549 (86)
Living	18.9850	19.3112	19.7564	20.2498	20.6293	20.8648	20.9516	20.9395	20.7845	20.3039	19.5753	18.9152
Non living	17.6592	18.0580	18.5990	19.1908	19.6227	19.8769	19.9543	19.9475	19.8002	19.2711	18.3995	17.5787
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	19.9692	19.3112	19.7564	20.2498	20.6293	20.8648	20.9516	20.9395	20.7845	20.3039	19.5753	19.2068 (87)
Th 2	19.9574	19.9593	19.9612	19.9706	19.9725	19.9820	19.9820	19.9839	19.9782	19.9725	19.9687	19.9649 (88)
util rest of house	0.8272	0.7814	0.7150	0.6161	0.4916	0.3498	0.2366	0.2613	0.4249	0.6334	0.7747	0.8395 (89)
MIT 2	19.0412	18.0580	18.5990	19.1908	19.6227	19.8769	19.9543	19.9475	19.8002	19.2711	18.3995	18.0087 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.4476	18.6069	19.1059	19.6546	20.0636	20.3096	20.3911	20.3819	20.2313	19.7234	18.9145	18.5335 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4476	18.6069	19.1059	19.6546	20.0636	20.3096	20.3911	20.3819	20.2313	19.7234	18.9145	18.5335 (93)

## 8. Space heating requirement

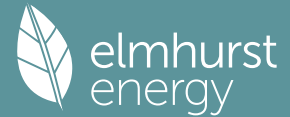
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8183	0.7518	0.6919	0.6051	0.4956	0.3682	0.2633	0.2881	0.4397	0.6233	0.7474	0.8144 (94)
Useful gains	365.5671	379.1667	381.8728	357.4476	303.5434	220.2802	151.8012	157.9704	229.1647	297.2716	327.2749	347.7154 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	643.5285	581.1401	533.3746	450.4093	349.5502	236.1676	156.8138	164.3631	254.6686	381.3068	495.8143	603.9993 (97)
Space heating kWh	206.8032	135.7262	112.7173	66.9324	34.2290	0.0000	0.0000	0.0000	0.0000	62.5222	121.3484	190.6752 (98a)
Space heating requirement - total per year (kWh/year)	930.9539											
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	206.8032	135.7262	112.7173	66.9324	34.2290	0.0000	0.0000	0.0000	0.0000	62.5222	121.3484	190.6752 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	930.9539											
Space heating per m2	(98c) / (4) =											

## 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 %)	232.2732 (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	206.8032	135.7262	112.7173	66.9324	34.2290	0.0000	0.0000	0.0000	0.0000	62.5222	121.3484	190.6752 (98)
Space heating efficiency (main heating system 1)	232.2732	232.2732	232.2732	232.2732	232.2732	0.0000	0.0000	0.0000	0.0000	232.2732	232.2732	232.2732 (210)
Space heating fuel (main heating system)	89.0345	58.4338	48.5279	28.8162	14.7365	0.0000	0.0000	0.0000	0.0000	26.9175	52.2438	82.0909 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (64)



# Full SAP Calculation Printout



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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 89.8610 (5)

## 2. Ventilation rate

	m <sup>3</sup> per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1500 (18)
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	6.3000	6.0000	6.0000	5.4000	5.2000	4.7000	4.5000	4.4000	4.9000	5.6000	5.8000	6.1000 (22)
Wind factor	1.5750	1.5000	1.5000	1.3500	1.3000	1.1750	1.1250	1.1000	1.2250	1.4000	1.4500	1.5250 (22a)
Adj infilt rate	0.1831	0.1744	0.1744	0.1569	0.1511	0.1366	0.1308	0.1279	0.1424	0.1627	0.1686	0.1773 (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	0.2781	0.2694	0.2694	0.2519	0.2461	0.2316	0.2258	0.2229	0.2374	0.2577	0.2636	0.2723 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Window (Uw = 1.20)			7.0500	1.1450	8.0725		(27)
Door			2.1000	0.5500	1.1550		(26a)
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			121.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 24.5942		(33)
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)
Internal Floor 1			18.4300			18.0000	331.7400 (32d)
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3149.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							85.5094 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.5000	0.0380	0.7410
E5 Ground floor (normal)	17.3000	0.1540	2.6642
E6 Intermediate floor within a dwelling	17.3000	0.0650	1.1245
E15 Flat roof with parapet	17.4500	0.3000	5.2350
E2 Other lintels (including other steel lintels)	6.2000	0.0370	0.2294
E3 Sill	5.2000	0.0330	0.1716
E4 Jamb	16.5000	0.0310	0.5115
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.6772 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 35.2714 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	8.2466	7.9881	7.9881	7.4710	7.2986	6.8677	6.6953	6.6092	7.0401	7.6434	7.8157	8.0743 (38)
Heat transfer coeff	43.5180	43.2595	43.2595	42.7424	42.5700	42.1391	41.9668	41.8806	42.3115	42.9148	43.0871	43.3457 (39)
Average = Sum(39)m / 12 =												42.7496

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1816	1.1746	1.1746	1.1605	1.1559	1.1442	1.1395	1.1371	1.1488	1.1652	1.1699	1.1769 (40)
HLP (average)												1.1607
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

## 4. Water heating energy requirements (kWh/year)



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Assumed occupancy												1.3249 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	53.4511	52.6573	51.5394	49.4783	47.9349	46.2235	45.2992	46.4092	47.6178	49.4490	51.5526	53.2704 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980 (42c)
Average daily hot water use (litres/day)												75.1921 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	81.6491	79.8299	77.6866	74.6001	72.0313	69.2946	68.3702	70.5057	72.7397	75.5963	78.7252	81.4684 (44)
Energy content (annual)	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1248.6735
Combi loss	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	83.1673	74.0810	79.8720	72.8314	72.4129	67.2061	67.6648	69.1985	68.6989	74.2800	76.1679	82.5847 (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	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8504	12.3018	10.0045	7.5740	5.6617	4.7798	5.1648	6.7134	9.0107	11.4411	13.3535	14.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.6291	171.3893	166.9536	157.5105	145.5904	134.3871	126.9026	125.1424	129.5781	139.0211	150.9413	162.1446 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	111.7841	110.2396	107.3549	101.1547	97.3292	93.3418	90.9472	93.0088	95.4151	99.8387	105.7888	111.0009 (72)
Total internal gains	366.0350	364.7021	355.0844	337.0107	319.3527	303.2802	293.7861	295.6360	304.7753	321.0724	340.8550	358.1523 (73)

## 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	0.5400	15.4404	0.7600	0.7000	0.7700	3.0740 (75)						
Southeast	1.0500	46.8814	0.7600	0.7000	0.7700	18.1483 (77)						
Southwest	4.4100	46.8814	0.7600	0.7000	0.7700	76.2227 (79)						
Northwest	1.0500	15.4404	0.7600	0.7000	0.7700	5.9771 (81)						
Solar gains	103.4221	153.8063	216.0501	286.9337	314.9035	346.5450	303.8238	290.4222	251.4257	178.4592	119.8719	84.8717 (83)
Total gains	469.4570	518.5084	571.1345	623.9444	634.2561	649.8252	597.6099	586.0581	556.2011	499.5316	460.7269	443.0240 (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	20.1022	20.2223	20.2223	20.4670	20.5499	20.7600	20.8453	20.8882	20.6754	20.3848	20.3032	20.1821
alpha	2.3401	2.3482	2.3482	2.3645	2.3700	2.3840	2.3897	2.3925	2.3784	2.3590	2.3535	2.3455
util living area	0.7958	0.7604	0.7039	0.6283	0.5317	0.4134	0.3436	0.3371	0.4429	0.6080	0.7327	0.8017 (86)
Living	19.4572	19.6519	19.9584	20.2954	20.6193	20.8400	20.9214	20.9279	20.8258	20.5022	19.9974	19.4891
Non living	18.2294	18.4639	18.8272	19.2267	19.5963	19.8348	19.9166	19.9242	19.8239	19.4768	18.8934	18.2750
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	20.2107	19.6519	19.9584	20.2954	20.6193	20.8400	20.9214	20.9279	20.8258	20.5022	19.9974	19.7004 (87)
Th 2	19.9348	19.9404	19.9404	19.9517	19.9555	19.9649	19.9687	19.9706	19.9612	19.9479	19.9442	19.9385 (88)
util rest of house	0.7731	0.7354	0.6744	0.5935	0.4879	0.3611	0.2816	0.2736	0.3838	0.5609	0.7002	0.7786 (89)
MIT 2	19.2549	18.4639	18.8272	19.2267	19.5963	19.8348	19.9166	19.9242	19.8239	19.4768	18.8934	18.5748 (90)
Living area fraction												FLA = Living area / (4) = 0.4380 (91)
MIT	19.6735	18.9842	19.3226	19.6947	20.0443	20.2750	20.3567	20.3638	20.2627	19.9259	19.3769	19.0678 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6735	18.9842	19.3226	19.6947	20.0443	20.2750	20.3567	20.3638	20.2627	19.9259	19.3769	19.0678 (93)

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## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7670	0.7099	0.6555	0.5844	0.4918	0.3772	0.3054	0.2984	0.4015	0.5599	0.6807	0.7569	(94)
Useful gains	360.0641	368.0876	374.3800	364.6413	311.9094	245.1174	182.5044	174.8658	223.2998	279.6730	313.6275	335.3066	(95)
Ext temp.	6.5000	6.7000	7.7000	9.1000	11.6000	14.0000	15.8000	16.0000	14.5000	12.0000	9.3000	7.0000	(96)
Heat loss rate W	573.2854	531.4086	502.7890	452.8449	359.4758	264.4239	191.2285	182.7580	243.8287	340.1374	434.1845	523.0859	(97)
Space heating kWh	158.6367	109.7517	95.5363	63.5065	35.3894	0.0000	0.0000	0.0000	0.0000	44.9855	86.8011	139.7078	(98a)
Space heating requirement - total per year (kWh/year)												734.3150	
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	158.6367	109.7517	95.5363	63.5065	35.3894	0.0000	0.0000	0.0000	0.0000	44.9855	86.8011	139.7078	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												734.3150	
Space heating per m2										(98c) / (4) =		19.9380	(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 %)													232.9348	(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	158.6367	109.7517	95.5363	63.5065	35.3894	0.0000	0.0000	0.0000	0.0000	44.9855	86.8011	139.7078	(98)	
Space heating efficiency (main heating system 1)	232.9348	232.9348	232.9348	232.9348	232.9348	0.0000	0.0000	0.0000	0.0000	232.9348	232.9348	232.9348	(210)	
Space heating fuel (main heating system)	68.1035	47.1169	41.0142	27.2637	15.1928	0.0000	0.0000	0.0000	0.0000	19.3125	37.2641	59.9772	(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	179.5260	159.0311	169.6152	150.7178	147.1818	133.7998	132.9017	137.5145	138.2893	152.7972	160.7525	177.7736	(64)	
Efficiency of water heater (217)m	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	(216)	
Fuel for water heating, kWh/month	90.4220	80.0993	85.4302	75.9122	74.1312	67.3911	66.9387	69.2621	69.6523	76.9595	80.9664	89.5394	(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	5.3259	4.8105	5.3259	5.1541	5.3259	5.1541	5.3259	5.3259	5.1541	5.3259	5.1541	5.3259	(231)	
Lighting	12.1232	9.7257	8.7569	6.4157	4.9556	4.0488	4.5207	5.8762	7.6326	10.0143	11.3112	12.4601	(232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-63.2863	-76.3551	-103.7274	-108.1172	-105.8646	-92.6536	-90.7815	-90.7071	-86.3288	-82.7477	-64.6364	-53.3584	(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	-54.1727	-96.5726	-198.1128	-315.8324	-394.3482	-445.8270	-395.0156	-361.7704	-267.7955	-149.7404	-70.7110	-40.4733	(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													315.2449	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													198.5424	
Water heating fuel used													926.7042	(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)													62.7086	(230a)
Total electricity for the above, kWh/year													62.7086	(231)
Electricity for lighting (calculated in Appendix L)													97.8409	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-3808.9362	(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													-2406.4376	(238)

## 10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	315.2449	21.5100	67.8092	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	926.7042	21.5100	199.3341	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	62.7086	21.5100	13.4886	(249)
Energy for lighting	97.8409	21.5100	21.0456	(250)

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Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1018.5643	21.5100	-219.0932
PV Unit electricity exported	-2790.3719	5.5900	-155.9818
Total			-375.0750 (252)
Total energy cost			-73.3975 (255)

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	315.2449	0.1550	48.8486 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	926.7042	0.1406	130.3256 (264)
Space and water heating			179.1742 (265)
Pumps, fans and electric keep-hot	62.7086	0.1387	8.6985 (267)
Energy for lighting	97.8409	0.1443	14.1215 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1018.5643	0.1369	-139.4354
PV Unit electricity exported	-2790.3719	0.1255	-350.1185
Total			-489.5539 (269)
Total CO2, kg/year			-287.5597 (272)

-----  
 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	315.2449	1.5736	496.0814 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	926.7042	1.5200	1408.5889 (278)
Space and water heating			1904.6702 (279)
Pumps, fans and electric keep-hot	62.7086	1.5128	94.8656 (281)
Energy for lighting	97.8409	1.5338	150.0716 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1018.5643	1.5061	-1534.0214
PV Unit electricity exported	-2790.3719	0.4606	-1285.1262
Total			-2819.1476 (283)
Total Primary energy kWh/year			-669.5403 (286)

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 SAP 10 EPC IMPROVEMENTS  
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DS SEC1 TF Scottish ACDs

Current energy efficiency rating: A 103  
 Current environmental impact rating: A 103

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	+ 2.1	-£ 44	-36 kg (12.4%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£44	0.97 kg/m <sup>2</sup>	A 105	A 104
Total Savings	£44	0.97 kg/m <sup>2</sup>		

Potential energy efficiency rating: A 105  
 Potential environmental impact rating: A 104

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)  
 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	£302	£239	£62
Space heating	£81	£99	-£17
Water heating	£199	£119	£80
Lighting	£21	£21	£0
Generated (PV)	-£375	-£357	-£18
Total cost of fuels	-£73	-£118	£44
Total cost of uses	-£74	-£118	£45
Delivered energy	-65 kWh/m <sup>2</sup>	-73 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>
Carbon dioxide emissions	-0.3 tonnes	-0.3 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	-8 kg/m <sup>2</sup>	-9 kg/m <sup>2</sup>	1 kg/m <sup>2</sup>
Primary energy	-18 kWh/m <sup>2</sup>	-27 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>

# Full SAP Calculation Printout



## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 89.8610 (5)

## 2. Ventilation rate

													m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)	
Number of open flues												0 * 20 = 0.0000 (6b)	
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)	
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)	
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)	
Number of blocked chimneys												0 * 20 = 0.0000 (6f)	
Number of intermittent extract fans												0 * 10 = 0.0000 (7a)	
Number of passive vents												0 * 10 = 0.0000 (7b)	
Number of flueless gas fires												0 * 40 = 0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) = 0.0000 (8)	
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												3.0000 (17)	
Infiltration rate												0.1500 (18)	
Number of sides sheltered												3 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.7750 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1162 (21)	
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1162	0.1250	0.1308	0.1366 (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	0.2432	0.2403	0.2374	0.2229	0.2200	0.2054	0.2054	0.2025	0.2112	0.2200	0.2258	0.2316 (25)	

## 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Window (Uw = 1.20)			7.0500	1.1450	8.0725		(27)					
Door			2.1000	0.5500	1.1550		(26a)					
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)					
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)					
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)					
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)					
Total net area of external elements Aum (A, m <sup>2</sup> )			121.4800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.5942	(33)					
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)					
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)					
Internal Floor 1			18.4300			18.0000	331.7400 (32d)					
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	3149.3100 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K						85.5094 (35)						
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				19.5000	0.0380	0.7410						
E5 Ground floor (normal)				17.3000	0.1540	2.6642						
E6 Intermediate floor within a dwelling				17.3000	0.0650	1.1245						
E15 Flat roof with parapet				17.4500	0.3000	5.2350						
E2 Other lintels (including other steel lintels)				6.2000	0.0370	0.2294						
E3 Sill				5.2000	0.0330	0.1716						
E4 Jamb				16.5000	0.0310	0.5115						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						10.6772 (36)						
Point Thermal bridges						(36a) = 0.0000						
Total fabric heat loss					(33) + (36) + (36a) =	35.2714 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 7.2124	Feb 7.1263	Mar 7.0401	Apr 6.6092	May 6.5230	Jun 6.0921	Jul 6.0921	Aug 6.0059	Sep 6.2644	Oct 6.5230	Nov 6.6953	Dec 6.8677 (38)
Heat transfer coeff	42.4839	42.3977	42.3115	41.8806	41.7944	41.3635	41.3635	41.2773	41.5359	41.7944	41.9668	42.1391 (39)
Average = Sum(39)m / 12 =												41.8590
HLP	Jan 1.1535	Feb 1.1512	Mar 1.1488	Apr 1.1371	May 1.1348	Jun 1.1231	Jul 1.1231	Aug 1.1208	Sep 1.1278	Oct 1.1348	Nov 1.1395	Dec 1.1442 (40)
HLP (average)												1.1365
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3249 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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	53.4511	52.6573	51.5394	49.4783	47.9349	46.2235	45.2992	46.4092	47.6178	49.4490	51.5526	53.2704 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980 (42c)
Average daily hot water use (litres/day)												75.1921 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.6491	79.8299	77.6866	74.6001	72.0313	69.2946	68.3702	70.5057	72.7397	75.5963	78.7252	81.4684 (44)
Energy conte	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598 (45)
Energy content (annual)	Total = Sum(45)m = 1248.6735											
Distribution loss (46)m = 0.15 x (45)m	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340 (46)
Water storage loss:												
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												
Enter (49) or (54) in (55)												
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	179.5260	159.0311	168.2195	143.9642	134.3875	121.1931	119.8747	125.4181	132.8864	151.4015	160.7525	177.7736 (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												
Zero-loss collector efficiency												
Collector linear heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector loop efficiency												
Incidence angle modifier												
Overshading factor												
Overall heat loss coefficient of system												
Heat loss coefficient of collector loop												
Dedicated solar storage volume												
Effective solar volume												
Reference volume												
Storage tank correction coefficient												
Heat delivered to hot water												
Heat delivered to space heating												
Solar input												
Solar input	-0.0000	-16.3441	-54.8620	-72.5359	-90.6148	-83.0843	-82.3385	-74.0055	-53.5308	-28.2376	-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	179.5260	142.6870	113.3575	71.4283	43.7727	38.1088	37.5362	51.4126	79.3557	123.1638	160.7525	177.7736 (64)
	Total per year (kWh/year) = Sum(64)m = 1218.8745 (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	83.1673	74.0810	78.7554	67.4285	62.1775	57.1208	57.2432	59.5214	64.3766	73.1634	76.1679	82.5847 (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	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8504	12.3018	10.0045	7.5740	5.6617	4.7798	5.1648	6.7134	9.0107	11.4411	13.3535	14.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.6291	171.3893	166.9536	157.5105	145.5904	134.3871	126.9026	125.1424	129.5781	139.0211	150.9413	162.1446 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	111.7841	110.2396	105.8541	93.6507	83.5718	79.3344	76.9398	80.0018	89.4119	98.3379	105.7888	111.0009 (72)
Total internal gains	366.0350	364.7021	353.5836	329.5067	305.5953	289.2727	279.7786	282.6290	298.7721	319.5716	340.8550	358.1523 (73)
-----												
6. Solar gains												
-----												
[Jan]			Area	Solar flux								
			m2	Table 6a	g	Specific data	FF	Access	Gains			
				W/m2	or Table 6b	Specific data	Factor	Factor	W			
						or Table 6c	Table 6d					
Northeast			0.5400	11.2829	0.7600	0.7000	0.7700		2.2463 (75)			
Southeast			1.0500	36.7938	0.7600	0.7000	0.7700		14.2433 (77)			
Southwest			4.4100	36.7938	0.7600	0.7000	0.7700		59.8217 (79)			
Northwest			1.0500	11.2829	0.7600	0.7000	0.7700		4.3677 (81)			
-----												
Solar gains	80.6789	139.6229	196.8736	253.7169	293.1117	294.9190	282.6992	252.7085	216.4647	155.8865	97.0348	68.7855 (83)
Total gains	446.7139	504.3251	550.4572	583.2236	598.7070	584.1917	562.4778	535.3376	515.2368	475.4581	437.8898	426.9377 (84)
-----												
7. Mean internal temperature (heating season)												
-----												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.5915	20.6334	20.6754	20.8882	20.9312	21.1493	21.1493	21.1934	21.0615	20.9312	20.8453	20.7600
alpha	2.3728	2.3756	2.3784	2.3925	2.3954	2.4100	2.4100	2.4129	2.4041	2.3954	2.3897	2.3840
util living area	0.8436	0.8012	0.7411	0.6543	0.5440	0.4137	0.3088	0.3354	0.4865	0.6732	0.7979	0.8549 (86)
Living	18.9850	19.3112	19.7527	20.2370	20.6158	20.8588	20.9492	20.9365	20.7802	20.3010	19.5753	18.9152
Non living	17.6592	18.0580	18.5947	19.1767	19.6093	19.8720	19.9529	19.9456	19.7965	19.2681	18.3995	17.5787
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0

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16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.9692	19.3112	19.7527	20.2370	20.6158	20.8588	20.9492	20.9365	20.7802	20.3010	19.5753	19.2068 (87)
Th 2	19.9574	19.9593	19.9612	19.9706	19.9725	19.9820	19.9820	19.9839	19.9782	19.9725	19.9687	19.9649 (88)
util rest of house												
	0.8272	0.7814	0.7159	0.6209	0.5000	0.3571	0.2421	0.2672	0.4289	0.6346	0.7747	0.8395 (89)
MIT 2	19.0412	18.0580	18.5947	19.1767	19.6093	19.8720	19.9529	19.9456	19.7965	19.2681	18.3995	18.0087 (90)
Living area fraction									fLA = Living area / (4) =			0.4380 (91)
MIT	19.4476	18.6069	19.1019	19.6411	20.0501	20.3042	20.3892	20.3796	20.2273	19.7205	18.9145	18.5335 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4476	18.6069	19.1019	19.6411	20.0501	20.3042	20.3892	20.3796	20.2273	19.7205	18.9145	18.5335 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8183	0.7518	0.6927	0.6095	0.5035	0.3755	0.2693	0.2943	0.4435	0.6243	0.7474	0.8144 (94)
Useful gains	365.5671	379.1667	381.3065	355.4601	301.4247	219.3704	151.4684	157.5657	228.5179	296.8447	327.2749	347.7154 (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	643.5285	581.1401	533.2031	449.8428	348.9878	235.9444	156.7350	164.2668	254.5037	381.1842	495.8143	603.9993 (97)
Space heating kWh	206.8032	135.7262	113.0111	67.9555	35.3869	0.0000	0.0000	0.0000	0.0000	62.7486	121.3484	190.6752 (98a)
Space heating requirement - total per year (kWh/year)												933.6551
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	206.8032	135.7262	113.0111	67.9555	35.3869	0.0000	0.0000	0.0000	0.0000	62.7486	121.3484	190.6752 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												933.6551
Space heating per m2												(98c) / (4) = 25.3504 (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 %)												232.2732 (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	206.8032	135.7262	113.0111	67.9555	35.3869	0.0000	0.0000	0.0000	0.0000	62.7486	121.3484	190.6752 (98)
Space heating efficiency (main heating system 1)	232.2732	232.2732	232.2732	232.2732	232.2732	0.0000	0.0000	0.0000	0.0000	232.2732	232.2732	232.2732 (210)
Space heating fuel (main heating system)	89.0345	58.4338	48.6544	29.2567	15.2350	0.0000	0.0000	0.0000	0.0000	27.0150	52.2438	82.0909 (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	179.5260	142.6870	113.3575	71.4283	43.7727	38.1088	37.5362	51.4126	79.3557	123.1638	160.7525	177.7736 (64)
Efficiency of water heater (217)m	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262	197.8262 (216)
Fuel for water heating, kWh/month	90.7493	72.1274	57.3015	36.1066	22.1268	19.2638	18.9743	25.9887	40.1138	62.2586	81.2595	89.8635 (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	12.1205	10.9475	12.1205	11.7295	12.1205	11.7295	12.1205	12.1205	12.1205	12.1205	11.7295	12.1205 (231)
Lighting	12.1232	9.7257	8.7569	6.4157	4.9556	4.0488	4.5207	5.8762	7.6326	10.0143	11.3112	12.4601 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-52.8651	-71.4078	-95.2743	-94.0176	-86.5659	-72.6271	-71.9564	-73.8717	-74.8380	-75.9779	-56.4804	-45.5484 (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	-35.2979	-79.7301	-171.0676	-273.0676	-373.6416	-382.0565	-375.8161	-313.2833	-221.6043	-119.8308	-48.9276	-27.6433 (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												401.9642 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												197.8262
Water heating fuel used												616.1340 (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)												62.7086 (230a)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												142.7086 (231)
Electricity for lighting (calculated in Appendix L)												97.8409 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3293.3975 (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												-2034.7498 (238)

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## 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	401.9642	16.4900	66.2839 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	616.1340	16.4900	101.6005 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	62.7086	16.4900	10.3406 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	97.8409	16.4900	16.1340 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-871.4307	16.4900	-143.6989
PV Unit electricity exported	-2421.9668	5.5900	-135.3879
Total			-279.0869 (252)
Total energy cost			-71.5359 (255)

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	-0.3147 (257)
SAP value		105.1015
SAP rating (Section 12)		105 (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	401.9642	0.1553	62.4446 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	616.1340	0.1474	90.7912 (264)
Space and water heating			153.2358 (265)
Pumps, fans and electric keep-hot	142.7086	0.1387	19.7954 (267)
Energy for lighting	97.8409	0.1443	14.1215 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-871.4307	0.1376	-119.8827
PV Unit electricity exported	-2421.9668	0.1242	-300.8191
Total			-420.7017 (269)
Total CO2, kg/year			-233.5491 (272)
CO2 emissions per m2			-6.3400 (273)
EI value			103.8245
EI rating			104 (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	18.4000 (1b)	x 2.5800 (2b)	= 47.4720 (1b) - (3b)
First floor	18.4300 (1c)	x 2.3000 (2c)	= 42.3890 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 89.8610 (5)

### 2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.1500 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1162 (21)

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

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Wind speed	6.3000	6.0000	6.0000	5.4000	5.2000	4.7000	4.5000	4.4000	4.9000	5.6000	5.8000	6.1000 (22)
Wind factor	1.5750	1.5000	1.5000	1.3500	1.3000	1.1750	1.1250	1.1000	1.2250	1.4000	1.4500	1.5250 (22a)
Adj infilt rate												
	0.1831	0.1744	0.1744	0.1569	0.1511	0.1366	0.1308	0.1279	0.1424	0.1627	0.1686	0.1773 (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	0.2781	0.2694	0.2694	0.2519	0.2461	0.2316	0.2258	0.2229	0.2374	0.2577	0.2636	0.2723 (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)			7.0500	1.1450	8.0725		(27)
Door			2.1000	0.5500	1.1550		(26a)
Floor 1 P/a 0.94			18.4300	0.1000	1.8430	75.0000	1382.2500 (28a)
External Wall 1 Render	39.7900	6.0000	33.7900	0.1500	5.0685	9.0000	304.1100 (29a)
External Wall 2 Clad	44.5500	3.1500	41.4000	0.1500	6.2100	9.0000	372.6000 (29a)
External Roof 1 Flat	18.7100		18.7100	0.1200	2.2452	9.0000	168.3900 (30)
Total net area of external elements Aum(A, m2)			121.4800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 24.5942		(33)
Internal Wall 1 GF			15.1800			9.0000	136.6200 (32c)
Internal Wall 2 FF			31.9700			9.0000	287.7300 (32c)
Internal Floor 1			18.4300			18.0000	331.7400 (32d)
Internal Ceiling 1			18.4300			9.0000	165.8700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3149.3100 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 85.5094 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.5000	0.0380	0.7410
E5 Ground floor (normal)	17.3000	0.1540	2.6642
E6 Intermediate floor within a dwelling	17.3000	0.0650	1.1245
E15 Flat roof with parapet	17.4500	0.3000	5.2350
E2 Other lintels (including other steel lintels)	6.2000	0.0370	0.2294
E3 Sill	5.2000	0.0330	0.1716
E4 Jamb	16.5000	0.0310	0.5115

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6772 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 35.2714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	8.2466	7.9881	7.9881	7.4710	7.2986	6.8677	6.6953	6.6092	7.0401	7.6434	7.8157	8.0743 (38)
Average = Sum(39)m / 12 =	43.5180	43.2595	43.2595	42.7424	42.5700	42.1391	41.9668	41.8806	42.3115	42.9148	43.0871	43.3457 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1816	1.1746	1.1746	1.1605	1.1559	1.1442	1.1395	1.1371	1.1488	1.1652	1.1699	1.1769 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy	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 (42)
Hot water usage for baths	53.4511	52.6573	51.5394	49.4783	47.9349	46.2235	45.2992	46.4092	47.6178	49.4490	51.5526	53.2704 (42b)
Hot water usage for other uses	28.1980	27.1726	26.1472	25.1218	24.0965	23.0711	23.0711	24.0965	25.1218	26.1472	27.1726	28.1980 (42c)
Average daily hot water use (litres/day)												75.1921 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	129.3122	113.6767	119.4014	102.1238	96.9680	85.2058	82.6879	87.3007	89.6953	102.5834	112.1585	127.5598 (45)
Energy content (annual)												Total = Sum(45)m = 1248.6735
Distribution loss (46)m = 0.15 x (45)m	19.3968	17.0515	17.9102	15.3186	14.5452	12.7809	12.4032	13.0951	13.4543	15.3875	16.8238	19.1340 (46)

Water storage loss:  
 Store volume 180.0000 (47)  
 a) If manufacturer declared loss factor is known (kWh/day):  
 Temperature factor from Table 2b 1.6100 (48)  
 Enter (49) or (54) in (55) 0.5400 (49)  
 Total storage loss 0.8694 (55)

If cylinder contains dedicated solar storage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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  
 179.5260 159.0311 168.2195 143.9642 134.3875 121.1931 119.8747 125.4181 132.8864 151.4015 160.7525 177.7736 (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												671.8011 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												671.8011



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Solar input	-8.0804	-25.0175	-66.2615	-85.1561	-97.5467	-95.7128	-87.7637	-86.0233	-67.5219	-41.0415	-11.6756	-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	171.4455	134.0136	101.9580	58.8081	36.8408	25.4803	32.1110	39.3947	65.3645	110.3599	149.0770	177.7736 (64)
												Total per year (kWh/year) = Sum(64)m = 1102.6270 (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	83.1673	74.0810	78.7554	67.4285	62.1775	57.1208	57.2432	59.5214	64.3766	73.1634	76.1679	82.5847 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921	79.4921 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8504	12.3018	10.0045	7.5740	5.6617	4.7798	5.1648	6.7134	9.0107	11.4411	13.3535	14.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.6291	171.3893	166.9536	157.5105	145.5904	134.3871	126.9026	125.1424	129.5781	139.0211	150.9413	162.1446 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741	44.2741 (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)	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947	-52.9947 (71)
Water heating gains (Table 5)	111.7841	110.2396	105.8541	93.6507	83.5718	79.3344	76.9398	80.0018	89.4119	98.3379	105.7888	111.0009 (72)
Total internal gains	366.0350	364.7021	353.5836	329.5067	305.5953	289.2727	279.7786	282.6290	298.7721	319.5716	340.8550	358.1523 (73)

## 6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
Northeast			0.5400	15.4404	0.7600	0.7000	0.7700	3.0740 (75)				
Southeast			1.0500	46.8814	0.7600	0.7000	0.7700	18.1483 (77)				
Southwest			4.4100	46.8814	0.7600	0.7000	0.7700	76.2227 (79)				
Northwest			1.0500	15.4404	0.7600	0.7000	0.7700	5.9771 (81)				
Solar gains	103.4221	153.8063	216.0501	286.9337	314.9035	346.5450	303.8238	290.4222	251.4257	178.4592	119.8719	84.8717 (83)
Total gains	469.4570	518.5084	569.6337	616.4404	620.4988	635.8178	583.6024	573.0512	550.1979	498.0308	460.7269	443.0240 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	20.1022	20.2223	20.2223	20.4670	20.5499	20.7600	20.8453	20.8882	20.6754	20.3848	20.3032	20.1821
alpha	2.3401	2.3482	2.3482	2.3645	2.3700	2.3840	2.3897	2.3925	2.3784	2.3590	2.3535	2.3455
util living area	0.7958	0.7604	0.7048	0.6328	0.5400	0.4209	0.3508	0.3439	0.4467	0.6091	0.7327	0.8017 (86)
Living	19.4572	19.6519	19.9552	20.2838	20.6061	20.8336	20.9178	20.9247	20.8225	20.5001	19.9974	19.4891
Non living	18.2294	18.4639	18.8236	19.2141	19.5831	19.8293	19.9140	19.9221	19.8211	19.4746	18.8934	18.2750
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	20.2107	19.6519	19.9552	20.2838	20.6061	20.8336	20.9178	20.9247	20.8225	20.5001	19.9974	19.7004 (87)
Th 2	19.9348	19.9404	19.9404	19.9517	19.9555	19.9649	19.9687	19.9706	19.9612	19.9479	19.9442	19.9385 (88)
util rest of house	0.7731	0.7354	0.6753	0.5981	0.4960	0.3680	0.2878	0.2794	0.3873	0.5621	0.7002	0.7786 (89)
MIT 2	19.2549	18.4639	18.8236	19.2141	19.5831	19.8293	19.9140	19.9221	19.8211	19.4746	18.8934	18.5748 (90)
Living area fraction									fLA = Living area / (4) =			0.4380 (91)
MIT	19.6735	18.9842	19.3192	19.6826	20.0311	20.2691	20.3536	20.3612	20.2597	19.9238	19.3769	19.0678 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6735	18.9842	19.3192	19.6826	20.0311	20.2691	20.3536	20.3612	20.2597	19.9238	19.3769	19.0678 (93)

## 8. Space heating requirement

Utilisation	0.7670	0.7099	0.6564	0.5886	0.4993	0.3840	0.3118	0.3044	0.4049	0.5609	0.6807	0.7569 (94)
Useful gains	360.0641	368.0876	373.8845	362.8142	309.8108	244.1244	181.9738	174.4082	222.7943	279.3496	313.6275	335.3066 (95)
Ext temp.	6.5000	6.7000	7.7000	9.1000	11.6000	14.0000	15.8000	16.0000	14.5000	12.0000	9.3000	7.0000 (96)
Heat loss rate W	573.2854	531.4086	502.6401	452.3239	358.9135	264.1764	191.1006	182.6481	243.7010	340.0468	434.1845	523.0859 (97)
Space heating kWh	158.6367	109.7517	95.7941	64.4470	36.5324	0.0000	0.0000	0.0000	0.0000	45.1587	86.8011	139.7078 (98a)
Space heating requirement - total per year (kWh/year)												736.8295
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	158.6367	109.7517	95.7941	64.4470	36.5324	0.0000	0.0000	0.0000	0.0000	45.1587	86.8011	139.7078 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												736.8295
Space heating per m2												(98c) / (4) = 20.0062 (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 %)												232.9348 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)

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Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	158.6367	109.7517	95.7941	64.4470	36.5324	0.0000	0.0000	0.0000	0.0000	45.1587	86.8011	139.7078	(98)
Space heating efficiency (main heating system 1)	232.9348	232.9348	232.9348	232.9348	232.9348	0.0000	0.0000	0.0000	0.0000	232.9348	232.9348	232.9348	(210)
Space heating fuel (main heating system)	68.1035	47.1169	41.1249	27.6674	15.6835	0.0000	0.0000	0.0000	0.0000	19.3868	37.2641	59.9772	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	171.4455	134.0136	101.9580	58.8081	36.8408	25.4803	32.1110	39.3947	65.3645	110.3599	149.0770	177.7736	(64)
Efficiency of water heater (217)m	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	198.5424	(216)
Fuel for water heating, kWh/month	86.3521	67.4987	51.3533	29.6199	18.5556	12.8337	16.1734	19.8420	32.9222	55.5851	75.0857	89.5394	(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	12.1205	10.9475	12.1205	11.7295	12.1205	11.7295	12.1205	12.1205	11.7295	12.1205	11.7295	12.1205	(231)
Lighting	12.1232	9.7257	8.7569	6.4157	4.9556	4.0488	4.5207	5.8762	7.6326	10.0143	11.3112	12.4601	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-63.4573	-75.5825	-97.9528	-95.0107	-86.1151	-69.5739	-70.8602	-72.4296	-75.7884	-79.9032	-64.7021	-53.6991	(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	-54.0017	-97.3452	-203.8875	-328.9389	-414.0976	-468.9067	-414.9370	-380.0479	-278.3359	-152.5849	-70.6453	-40.1326	(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													316.3244 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													198.5424
Water heating fuel used													555.3610 (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)													62.7086 (230a)
pump for solar water heating													80.0000 (230g)
Total electricity for the above, kWh/year													142.7086 (231)
Electricity for lighting (calculated in Appendix L)													97.8409 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3808.9362 (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													-2696.7013 (238)

## 10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	316.3244	21.5100	68.0414	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	555.3610	21.5100	119.4582	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	62.7086	21.5100	13.4886	(249)
Pump for solar water heating	80.0000	21.5100	17.2080	(249)
Energy for lighting	97.8409	21.5100	21.0456	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-905.0749	21.5100	-194.6816	
PV Unit electricity exported	-2903.8612	5.5900	-162.3258	
Total			-357.0075	(252)
Total energy cost			-117.7657	(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	316.3244	0.1549	48.9981	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	555.3610	0.1485	82.4838	(264)
Space and water heating			131.4819	(265)
Pumps, fans and electric keep-hot	142.7086	0.1387	19.7954	(267)
Energy for lighting	97.8409	0.1443	14.1215	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-905.0749	0.1385	-125.3397	
PV Unit electricity exported	-2903.8612	0.1251	-363.2481	
Total			-488.5878	(269)
Total CO2, kg/year			-323.1890	(272)

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 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	316.3244	1.5734	497.7141 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	555.3610	1.5495	860.5376 (278)
Space and water heating			1358.2517 (279)
Pumps, fans and electric keep-hot	142.7086	1.5128	215.8896 (281)
Energy for lighting	97.8409	1.5338	150.0716 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-905.0749	1.5120	-1368.5140
PV Unit electricity exported	-2903.8612	0.4591	-1333.2746
Total			-2701.7886 (283)
Total Primary energy kWh/year			-977.5758 (286)