

# Full SAP Calculation Printout



Property Reference	CPG-7172-23 P19 & 20		Issued on Date	12/01/2024	
Assessment Reference	SEC1 - ASHP ROI TF 0.15 improv	Prop Type Ref	DS		
Property	Plots 19 & 20, Collygree Parc, South Road, Penzance, Cornwall, TR20 9LY				
SAP Rating	98 A	DER	-0.42	TER	9.62
Environmental	100 A	% DER < TER			104.37
CO <sub>2</sub> Emissions (t/year)	-0.16	DFEE	32.18	TFEE	38.55
Compliance Check	See BREL	% DFEE < TFEE			16.53
% DPER < TPER	87.73	DPER	6.16	TPER	50.19
Assessor Details	Mr. Stuart Thomas			Assessor ID	V220-0003
Client	Cornwall Planning Group, CPG				

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	318.1125 (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	1.0000 (17)
Infiltration rate	0.0500 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.0425 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449 (25)

## 3. Heat losses and heat loss parameter

Element	Gross m <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)			24.8000	1.1450	28.3969		(27)
Door			4.0100	1.0000	4.0100		(26a)
Floor 1 P/a 0.5			63.7500	0.1200	7.6500	110.0000	(28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1500	19.6305	9.0000	(29a)
External Roof 1 Horz	63.7500		63.7500	0.0900	5.7375	9.0000	(30)
Total net area of external elements Aum(A, m <sup>2</sup> )			287.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.4249		(33)
Internal Wall 1 GF			106.1800			9.0000	(32c)
Internal Wall 2 FF			146.9800			9.0000	(32c)
Internal Floor 1			63.7500			18.0000	(32d)
Internal Ceiling 1			63.7500			9.0000	(32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12763.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.1080 (35)

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List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	32.0000	0.0210	0.6720
E10 Eaves (insulation at ceiling level)	17.0000	0.0440	0.7480
E12 Gable (insulation at ceiling level)	15.0000	0.0510	0.7650
E6 Intermediate floor within a dwelling	32.0000	0.0800	2.5600
E2 Other lintels (including other steel lintels)	19.2600	0.0840	1.6178
E3 Sill	17.3500	0.0430	0.7460
E4 Jamb	42.0000	0.0340	1.4280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1357 (36)  
 Point Thermal bridges 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 74.5606 (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	15.6613	15.5497	15.4382	14.8805	14.7690	14.2113	14.2113	14.0997	14.4344	14.7690	14.9920	15.2151 (38)
Average = Sum(39)m / 12 =	90.2219	90.1104	89.9988	89.4411	89.3296	88.7719	88.7719	88.6604	88.9950	89.3296	89.5527	89.7758 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7076	0.7067	0.7059	0.7015	0.7006	0.6963	0.6963	0.6954	0.6980	0.7006	0.7024	0.7041 (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 (42a)
Hot water usage for baths	83.7993	82.5548	80.8022	77.5708	75.1511	72.4681	71.0189	72.7592	74.6541	77.5250	80.8230	83.5160 (42b)
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081 (42c)
Average daily hot water use (litres/day)												117.8843 (43)
Daily hot water use	128.0074	125.1553	121.7952	116.9562	112.9289	108.6384	107.1891	110.5370	114.0395	118.5179	123.4235	127.7241 (44)
Energy content (annual)	202.7324	178.2195	187.1946	160.1071	152.0241	133.5836	129.6360	136.8679	140.6221	160.8277	175.8394	199.9851 (45)
Distribution loss (46)m = 0.15 x (45)m	30.4099	26.7329	28.0792	24.0161	22.8036	20.0375	19.4454	20.5302	21.0933	24.1242	26.3759	29.9978 (46)
Water storage loss:												250.0000 (47)
Store volume												1.6000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.8640 (55)
Enter (49) or (54) in (55)												
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315 (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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315 (64)
Total per year (kWh/year)												2546.8954 (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	107.4457	95.4205	102.2793	91.9812	90.5851	83.1621	83.1411	85.5457	85.5024	93.5123	97.2122	106.5322 (65)

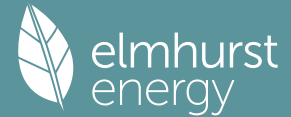
#### 5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.1512	166.2389	150.1512	155.1563	150.1512	155.1563	150.1512	150.1512	155.1563	150.1512	155.1563	150.1512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.6815	297.7394	290.0336	273.6290	252.9212	233.4587	220.4566	217.3987	225.1044	241.5090	262.2169	281.6794 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410 (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)	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281 (71)
Water heating gains (Table 5)	144.4162	141.9948	137.4722	127.7517	121.7542	115.5030	111.7488	114.9808	118.7534	125.6886	135.0169	143.1884 (72)
Total internal gains	655.5720	672.2961	643.9801	622.8601	591.1496	570.4410	548.6796	548.8538	565.3371	583.6719	618.7132	641.3420 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Southeast	14.6100	36.7938	0.7600	0.7000	0.7700	198.1847 (77)						
Northwest	10.1900	11.2829	0.7600	0.7000	0.7700	42.3878 (81)						
Solar gains	240.5725	423.8636	617.3464	827.6064	984.2036	1002.2534	955.8059	835.1298	689.5547	478.5429	290.7145	204.2209 (83)

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Total gains 896.1445 1096.1597 1261.3265 1450.4665 1575.3532 1572.6944 1504.4855 1383.9835 1254.8918 1062.2149 909.4276 845.5629 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2975	39.3461	39.3949	39.6405	39.6900	39.9393	39.9393	39.9896	39.8392	39.6900	39.5911	39.4928	
alpha	3.6198	3.6231	3.6263	3.6427	3.6460	3.6626	3.6626	3.6660	3.6559	3.6460	3.6394	3.6329	
util living area	0.9321	0.8781	0.7970	0.6584	0.5019	0.3557	0.2582	0.2923	0.4703	0.7294	0.8879	0.9424 (86)	
Living	19.9643	20.2235	20.4904	20.7349	20.8585	20.9033	20.9129	20.9112	20.8818	20.6965	20.2950	19.9067	
Non living	19.1020	19.4234	19.7487	20.0390	20.1766	20.2259	20.2343	20.2339	20.2050	20.0026	19.5198	19.0324	
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	20.4702	20.2235	20.4904	20.7349	20.8585	20.9033	20.9129	20.9112	20.8818	20.6965	20.2950	20.0596 (87)	
Th 2	20.3341	20.3349	20.3356	20.3395	20.3403	20.3441	20.3441	20.3449	20.3426	20.3403	20.3387	20.3372 (88)	
util rest of house	0.9245	0.8660	0.7788	0.6327	0.4707	0.3207	0.2202	0.2515	0.4299	0.7007	0.8746	0.9358 (89)	
MIT 2	19.8429	19.4234	19.7487	20.0390	20.1766	20.2259	20.2343	20.2339	20.2050	20.0026	19.5198	19.2675 (90)	
Living area fraction									flA = Living area / (4) =			0.1104 (91)	
MIT	19.9122	19.5117	19.8306	20.1158	20.2519	20.3007	20.3092	20.3087	20.2798	20.0792	19.6054	19.3550 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.9122	19.5117	19.8306	20.1158	20.2519	20.3007	20.3092	20.3087	20.2798	20.0792	19.6054	19.3550 (93)	

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9192	0.8491	0.7638	0.6237	0.4664	0.3183	0.2182	0.2492	0.4259	0.6885	0.8577	0.9244 (94)
Useful gains	823.7527	930.7990	963.4150	904.6219	734.8148	500.6430	328.2873	344.9246	534.4985	731.3571	780.0610	781.6479 (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	1408.5615	1316.6672	1199.7371	1003.1577	763.9371	506.0650	329.2735	346.5490	549.9685	846.7718	1119.8939	1360.5512 (97)
Space heating kWh	435.0978	259.3034	175.8237	70.9458	21.6670	0.0000	0.0000	0.0000	0.0000	85.8686	244.6797	430.7041 (98a)
Space heating requirement - total per year (kWh/year)												1724.0900
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	435.0978	259.3034	175.8237	70.9458	21.6670	0.0000	0.0000	0.0000	0.0000	85.8686	244.6797	430.7041 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1724.0900
Space heating per m2										(98c) / (4) =		13.5223 (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 %)													383.6065 (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	435.0978	259.3034	175.8237	70.9458	21.6670	0.0000	0.0000	0.0000	0.0000	85.8686	244.6797	430.7041 (98)	
Space heating efficiency (main heating system 1)	383.6065	383.6065	383.6065	383.6065	383.6065	0.0000	0.0000	0.0000	0.0000	383.6065	383.6065	383.6065 (210)	
Space heating fuel (main heating system)	113.4229	67.5962	45.8344	18.4944	5.6482	0.0000	0.0000	0.0000	0.0000	22.3846	63.7840	112.2776 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315 (64)	
Efficiency of water heater (217)m	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825 (216)	
Fuel for water heating, kWh/month	125.1489	110.6149	117.4562	103.2462	100.0436	90.1145	88.9594	92.5399	93.5992	104.4022	111.0351	123.7887 (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	27.5560	24.8893	27.5560	26.6671	27.5560	26.6671	27.5560	26.6671	26.6671	27.5560	26.6671	27.5560 (231)	
Lighting	29.0303	23.2892	20.9694	15.3631	11.8669	9.6953	10.8254	14.0712	18.2771	23.9805	27.0860	29.8372 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-55.7364	-81.9346	-122.6093	-140.8554	-153.7939	-143.8541	-141.9387	-132.8215	-115.5436	-94.2739	-61.8904	-47.5774 (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	-23.6102	-54.0895	-117.0984	-189.5212	-260.3928	-265.3611	-261.0566	-215.6180	-151.2545	-81.9540	-32.9769	-18.2951 (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												449.4424 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												201.9825	
Water heating fuel used												1260.9487 (219)	
Space cooling fuel												0.0000 (221)	

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Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)		
mechanical ventilation fans (SFP = 0.8360)	324.4493	(230a)
Total electricity for the above, kWh/year	324.4493	(231)
Electricity for lighting (calculated in Appendix L)	234.2915	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2964.0577	(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	-694.9259	(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	449.4424	0.1573	70.6832 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1260.9487	0.1409	177.6528 (264)
Space and water heating			248.3360 (265)
Pumps, fans and electric keep-hot	324.4493	0.1387	45.0051 (267)
Energy for lighting	234.2915	0.1443	33.8155 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1292.8293	0.1341	-173.3087
PV Unit electricity exported	-1671.2285	0.1240	-207.3071
Total			-380.6158 (269)
Total CO2, kg/year			-53.4593 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.4200 (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	449.4424	1.5821	711.0832 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1260.9487	1.5210	1917.8432 (278)
Space and water heating			2628.9264 (279)
Pumps, fans and electric keep-hot	324.4493	1.5128	490.8269 (281)
Energy for lighting	234.2915	1.5338	359.3642 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1292.8293	1.4954	-1933.3174
PV Unit electricity exported	-1671.2285	0.4553	-760.8393
Total			-2694.1567 (283)
Total Primary energy kWh/year			784.9608 (286)
Dwelling Primary energy Rate (DPER)			6.1600 (287)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS  
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-----  
1. Overall dwelling characteristics  
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	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	318.1125 (5)

-----  
2. Ventilation rate  
-----

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1257 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3757 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3194 (21)

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	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	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753	(22b)
	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704	(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			4.0100	1.0000	4.0100			(26a)
TER Opening Type (Uw = 1.20)			24.8000	1.1450	28.3969			(27)
Floor 1 P/a 0.5			63.7500	0.1300	8.2875			(28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1800	23.5566			(29a)
External Roof 1 Horz	63.7500		63.7500	0.1100	7.0125			(30)
Total net area of external elements Aum(A, m2)			287.1800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.2635		(33)

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

100.1080 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	19.9600	0.0900	1.7964	
E5 Ground floor (normal)	32.0000	0.1600	5.1200	
E10 Eaves (insulation at ceiling level)	17.0000	0.0600	1.0200	
E12 Gable (insulation at ceiling level)	15.0000	0.0600	0.9000	
E6 Intermediate floor within a dwelling	32.0000	0.0000	0.0000	
E2 Other lintels (including other steel lintels)	19.2600	0.0500	0.9630	
E3 Sill	17.3500	0.0500	0.8675	
E4 Jamb	42.0000	0.0500	2.1000	

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

12.7669 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 84.0304 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.1922	60.8542	60.5230	58.9669	58.6758	57.3206	57.3206	57.0696	57.8426	58.6758	59.2648	59.8805	(38)
Heat transfer coeff	145.2227	144.8847	144.5534	142.9974	142.7063	141.3510	141.3510	141.1001	141.8730	142.7063	143.2952	143.9109	(39)
Average = Sum(39)m / 12 =													142.9960

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1390	1.1364	1.1338	1.1215	1.1193	1.1086	1.1086	1.1067	1.1127	1.1193	1.1239	1.1287	(40)
HLP (average)													1.1215
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy													2.8882	(42)	
Hot water usage for mixer showers														(42a)	
Hot water usage for baths	83.7993	82.5548	80.8022	77.5708	75.1511	72.4681	71.0189	72.7592	74.6541	77.5250	80.8230	83.5160		(42b)	
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081		(42c)	
Average daily hot water use (litres/day)														(43)	
Daily hot water use	128.0074	125.1553	121.7952	116.9562	112.9289	108.6384	107.1891	110.5370	114.0395	118.5179	123.4235	127.7241		(44)	
Energy conte	202.7324	178.2195	187.1946	160.1071	152.0241	133.5836	129.6360	136.8679	140.6221	160.8277	175.8394	199.9851		(45)	
Energy content (annual)														(45)	
Distribution loss (46)m = 0.15 x (45)m	30.4099	26.7329	28.0792	24.0161	22.8036	20.0375	19.4454	20.5302	21.0933	24.1242	26.3759	29.9978		(46)	
Water storage loss:														(46)	
Store volume														250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):														1.8903	(48)
Temperature factor from Table 2b														0.5400	(49)
Enter (49) or (54) in (55)														1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444		(56)	
If cylinder contains dedicated solar storage														(56)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624		(57)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(59)	
Total heat required for water heating calculated for each month	257.6392	227.8127	242.1014	213.2428	206.9309	186.7192	184.5428	191.7747	193.7577	215.7345	228.9750	254.8919		(61)	
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(62)	
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000		(63a)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63b)	
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(63c)	
Output from w/h	257.6392	227.8127	242.1014	213.2428	206.9309	186.7192	184.5428	191.7747	193.7577	215.7345	228.9750	254.8919		(63d)	
12Total per year (kWh/year)														2604.1226	(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		2604	(64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =														0.0000	(64a)
Heat gains from water heating, kWh/month	111.3340	98.9326	106.1676	95.7441	94.4734	86.9250	87.0294	89.4340	89.2653	97.4007	100.9751	110.4205		(64b)	

### 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	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.1512	166.2389	150.1512	155.1563	150.1512	155.1563	150.1512	155.1563	150.1512	155.1563	150.1512	155.1563	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.6815	297.7394	290.0336	273.6290	252.9212	233.4587	220.4566	217.3987	225.1044	241.5090	262.2169	281.6794	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410 (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)	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281 (71)
Water heating gains (Table 5)	149.6424	147.2211	142.6984	132.9779	126.9804	120.7292	116.9750	120.2070	123.9796	130.9149	140.2432	148.4146 (72)
Total internal gains	663.7982	680.5224	652.2064	631.0863	599.3759	575.6672	553.9058	554.0800	570.5634	591.8982	626.9394	649.5683 (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						
Southeast	14.6100	36.7938	0.6300	0.7000	0.7700	164.2847 (77)						
Northwest	10.1900	11.2829	0.6300	0.7000	0.7700	35.1373 (81)						
Solar gains	199.4220	351.3606	511.7477	686.0422	815.8529	830.8154	792.3128	692.2786	571.6045	396.6869	240.9870	169.2883 (83)
Total gains	863.2202	1031.8829	1163.9540	1317.1285	1415.2288	1406.4825	1346.2186	1246.3586	1142.1679	988.5851	867.9264	818.8566 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.4142	24.4711	24.5272	24.7941	24.8447	25.0829	25.0829	25.1275	24.9906	24.8447	24.7426	24.6367
alpha	2.6276	2.6314	2.6351	2.6529	2.6563	2.6722	2.6722	2.6752	2.6660	2.6563	2.6495	2.6424
util living area	0.9563	0.9312	0.8930	0.8165	0.7028	0.5552	0.4285	0.4728	0.6691	0.8533	0.9344	0.9614 (86)
MIT	18.4333	18.7971	19.3016	19.9429	20.4627	20.7994	20.9268	20.9031	20.6523	19.9652	19.0954	18.3746 (87)
Th 2	19.9691	19.9713	19.9734	19.9833	19.9851	19.9938	19.9938	19.9954	19.9905	19.9851	19.9814	19.9775 (88)
util rest of house	0.9499	0.9215	0.8775	0.7896	0.6584	0.4880	0.3415	0.3844	0.6065	0.8257	0.9234	0.9557 (89)
MIT 2	16.9724	17.4309	18.0629	18.8545	19.4659	19.8357	19.9521	19.9367	19.6934	18.9008	17.8197	16.9031 (90)
Living area fraction	17.1337	17.5818	18.1997	18.9747	19.5759	19.9421	20.0597	20.0434	19.7993	19.0183	17.9606	0.1104 (91)
MIT	17.1337	17.5818	18.1997	18.9747	19.5759	19.9421	20.0597	20.0434	19.7993	19.0183	17.9606	17.0656 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1337	17.5818	18.1997	18.9747	19.5759	19.9421	20.0597	20.0434	19.7993	19.0183	17.9606	17.0656 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9243	0.8905	0.8432	0.7579	0.6385	0.4843	0.3474	0.3889	0.5933	0.7930	0.8932	0.9319 (94)
Useful gains	797.8903	918.8601	981.4580	998.3052	903.6701	681.2264	467.7130	484.6887	677.6323	783.9065	775.2089	763.1112 (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	1863.7511	1837.3949	1691.2347	1440.6559	1123.9466	755.1089	489.0336	514.0829	808.5723	1201.3441	1556.2729	1851.4959 (97)
Space heating kWh	793.0005	617.2553	528.0739	318.4925	163.8857	0.0000	0.0000	0.0000	0.0000	310.5736	562.3661	809.7582 (98a)
Space heating requirement - total per year (kWh/year)												4103.4058
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	793.0005	617.2553	528.0739	318.4925	163.8857	0.0000	0.0000	0.0000	0.0000	310.5736	562.3661	809.7582 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4103.4058
Space heating per m2												(98c) / (4) = 32.1836 (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	793.0005	617.2553	528.0739	318.4925	163.8857	0.0000	0.0000	0.0000	0.0000	310.5736	562.3661	809.7582 (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)	859.1554	668.7490	572.1277	345.0623	177.5577	0.0000	0.0000	0.0000	0.0000	336.4828	609.2807	877.3112 (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	257.6392	227.8127	242.1014	213.2428	206.9309	186.7192	184.5428	191.7747	193.7577	215.7345	228.9750	254.8919 (64)
Efficiency of water heater (217)m	86.4102	86.1798	85.7596	84.9574	83.5421	79.8000	79.8000	79.8000	79.8000	84.8762	85.9937	79.8000 (216)
Fuel for water heating, kWh/month	298.1584	264.3458	282.3024	250.9995	247.6965	233.9839	231.2566	240.3192	242.8041	254.1755	266.2694	294.7909 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	31.1985	25.0286	22.5354	16.5104	12.7531	10.4194	11.6338	15.1221	19.6421	25.7715	29.1089	32.0656 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-56.7056	-78.4865	-110.7612	-122.1493	-129.6713	-120.2177	-118.6190	-112.8985	-102.6170	-88.4969	-61.7744	-49.1885 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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	-36.6370	-76.4927	-151.0212	-225.4176	-296.7744	-297.8122	-294.4101	-249.9525	-184.0403	-109.0437	-48.7908	-29.0251	(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													4445.7268 (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													3107.1021 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													251.7895 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-3151.0035 (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													4739.6149 (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	4445.7268	0.2100	933.6026 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3107.1021	0.2100	652.4914 (264)
Space and water heating			1586.0941 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	251.7895	0.1443	36.3410 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1151.5858	0.1350	-155.4692
PV Unit electricity exported	-1999.4177	0.1261	-252.0714
Total			-407.5407 (269)
Total CO2, kg/year			1226.8237 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6200 (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	4445.7268	1.1300	5023.6713 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3107.1021	1.1300	3511.0253 (278)
Space and water heating			8534.6966 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	251.7895	1.5338	386.2031 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1151.5858	1.4990	-1726.2008
PV Unit electricity exported	-1999.4177	0.4628	-925.2903
Total			-2651.4910 (283)
Total Primary energy kWh/year			6399.5095 (286)
Target Primary Energy Rate (TPER)			50.1900 (287)

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

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 318.1125 (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)

# Full SAP Calculation Printout



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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.1257 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 1.0000 (17)  
 Infiltration rate 0.1757 (18)  
 Number of sides sheltered 2 (19)  
 Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1494 (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	0.1905	0.1867	0.1830	0.1643	0.1606	0.1419	0.1419	0.1382	0.1494	0.1606	0.1681	0.1755 (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	0.5181	0.5174	0.5167	0.5135	0.5129	0.5101	0.5101	0.5095	0.5112	0.5129	0.5141	0.5154 (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)			24.8000	1.1450	28.3969		(27)
Door			4.0100	1.0000	4.0100		(26a)
Floor 1 P/a 0.5			63.7500	0.1200	7.6500	110.0000	7012.5000 (28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1500	19.6305	9.0000	1177.8300 (29a)
External Roof 1 Horz	63.7500		63.7500	0.0900	5.7375	9.0000	573.7500 (30)
Total net area of external elements Aum(A, m2)			287.1800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 65.4249		(33)
Internal Wall 1 GF			106.1800			9.0000	955.6200 (32c)
Internal Wall 2 FF			146.9800			9.0000	1322.8200 (32c)
Internal Floor 1			63.7500			18.0000	1147.5000 (32d)
Internal Ceiling 1			63.7500			9.0000	573.7500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12763.7700 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.1080 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	32.0000	0.0210	0.6720
E10 Eaves (insulation at ceiling level)	17.0000	0.0440	0.7480
E12 Gable (insulation at ceiling level)	15.0000	0.0510	0.7650
E6 Intermediate floor within a dwelling	32.0000	0.0800	2.5600
E2 Other lintels (including other steel lintels)	19.2600	0.0840	1.6178
E3 Sill	17.3500	0.0430	0.7460
E4 Jamb	42.0000	0.0340	1.4280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1357 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 74.5606 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	54.3926	54.3187	54.2462	53.9058	53.8421	53.5456	53.5456	53.4907	53.6598	53.8421	53.9709	54.1056 (38)
Average = Sum(39)m / 12 =	128.9532	128.8793	128.8068	128.4664	128.4027	128.1063	128.1063	128.0514	128.2205	128.4027	128.5316	128.6663 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0114	1.0108	1.0102	1.0076	1.0071	1.0048	1.0048	1.0043	1.0057	1.0071	1.0081	1.0091 (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 (42a)
Hot water usage for baths	31.3632	30.8974	30.2414	29.0320	28.1264	27.1223	26.5799	27.2312	27.9404	29.0149	30.2492	31.2571 (42b)
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081 (42c)
Average daily hot water use (litres/day)												69.2678 (43)
Daily hot water use	75.5712	73.4979	71.2344	68.4174	65.9043	63.2925	62.7501	65.0091	67.3258	70.0079	72.8497	75.4652 (44)
Energy conte	119.6864	104.6600	109.4846	93.6600	88.7198	77.8256	75.8909	80.4948	83.0195	95.0000	103.7878	118.1603 (45)
Energy content (annual)												Total = Sum(45)m = 1150.3897
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	101.7334	88.9610	93.0619	79.6110	75.4118	66.1517	64.5072	68.4206	70.5665	80.7500	88.2196	100.4363 (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												



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101.7334	88.9610	93.0619	79.6110	75.4118	66.1517	64.5072	68.4206	70.5665	80.7500	88.2196	100.4363 (64)
12Total per year (kWh/year)											977.8312 (64)
Electric shower(s)											978 (64)
58.1769	51.8361	56.6031	54.0156	55.0292	52.4925	54.2423	55.0292	54.0156	56.6031	55.5387	58.1769 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											661.7593 (64a)
Heat gains from water heating, kWh/month											
39.9776	35.1993	37.4162	33.4067	32.6103	29.6611	29.6874	30.8624	31.1455	34.3383	35.9396	39.6533 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	150.1512	166.2389	150.1512	155.1563	150.1512	155.1563	150.1512	150.1512	155.1563	150.1512	155.1563	150.1512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	294.6815	297.7394	290.0336	273.6290	252.9212	233.4587	220.4566	217.3987	225.1044	241.5090	262.2169	281.6794 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410 (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)												
	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281 (71)
Water heating gains (Table 5)												
	53.7333	52.3799	50.2907	46.3981	43.8310	41.1959	39.9024	41.4818	43.2577	46.1536	49.9161	53.2974 (72)
Total internal gains												
	564.8891	582.6812	556.7986	541.5065	513.2264	496.1339	476.8332	475.3547	489.8414	504.1369	533.6123	551.4511 (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							
Southeast	14.6100	36.7938	0.7600	0.7000	0.7700	198.1847 (77)						
Northwest	10.1900	11.2829	0.7600	0.7000	0.7700	42.3878 (81)						
Solar gains	240.5725	423.8636	617.3464	827.6064	984.2036	1002.2534	955.8059	835.1298	689.5547	478.5429	290.7145	204.2209 (83)
Total gains	805.4616	1006.5447	1174.1450	1369.1129	1497.4300	1498.3874	1432.6391	1310.4845	1179.3961	982.6798	824.3268	755.6719 (84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	27.4944	27.5102	27.5257	27.5986	27.6123	27.6762	27.6762	27.6880	27.6515	27.6123	27.5846	27.5557
alpha	2.8330	2.8340	2.8350	2.8399	2.8408	2.8451	2.8451	2.8459	2.8434	2.8408	2.8390	2.8370
util living area												
	0.9605	0.9293	0.8802	0.7845	0.6512	0.4977	0.3762	0.4228	0.6264	0.8403	0.9368	0.9664 (86)
MIT	18.6833	19.0864	19.5988	20.1924	20.6318	20.8753	20.9584	20.9412	20.7544	20.1430	19.2950	18.5950 (87)
Th 2	20.0738	20.0743	20.0748	20.0770	20.0774	20.0794	20.0794	20.0797	20.0786	20.0774	20.0766	20.0757 (88)
util rest of house												
	0.9549	0.9198	0.8643	0.7569	0.6085	0.4380	0.3033	0.3468	0.5674	0.8128	0.9267	0.9616 (89)
MIT 2	17.9501	18.3450	18.8425	19.4052	19.8007	20.0026	20.0605	20.0515	19.9147	19.3741	18.5570	17.8645 (90)
Living area fraction												
	18.0311	18.4269	18.9260	19.4922	19.8925	20.0990	20.1597	20.1498	20.0075	19.4591	18.6385	17.9451 (91)
Temperature adjustment												
	18.0311	18.4269	18.9260	19.4922	19.8925	20.0990	20.1597	20.1498	20.0075	19.4591	18.6385	17.9451 (93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9385	0.8985	0.8408	0.7373	0.5993	0.4394	0.3098	0.3528	0.5625	0.7911	0.9063	0.9466 (94)
Useful gains	755.9006	904.4220	987.2013	1009.4523	897.3400	658.3221	443.8958	462.3197	663.3580	777.3705	747.1163	715.3485 (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												
	1770.6673	1743.3343	1600.5532	1360.7386	1051.9367	704.4547	456.0150	480.1649	757.4560	1137.5265	1483.0643	1768.5364 (97)
Space heating kWh												
	754.9865	563.7491	456.3338	252.9261	115.0200	0.0000	0.0000	0.0000	0.0000	267.9560	529.8826	783.5718 (98a)
Space heating requirement - total per year (kWh/year)												
												3724.4258
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												
	754.9865	563.7491	456.3338	252.9261	115.0200	0.0000	0.0000	0.0000	0.0000	267.9560	529.8826	783.5718 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												3724.4258
Space heating per m2												
												29.2112 (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	1204.1988	947.9863	973.1903	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8491	0.8956	0.8692	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	1022.4525	849.0492	845.8861	0.0000	0.0000	0.0000	0.0000 (102)
Total gains												
	0.0000	0.0000	0.0000	0.0000	0.0000	1687.2259	1613.2949	1473.5167	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	478.6368	568.5988	466.9572	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												
												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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	119.6592	142.1497	116.7393	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												378.5482 (107)
Energy for space heating												29.2112 (99)
Energy for space cooling												2.9690 (108)
Total												32.1802 (109)
Fabric Energy Efficiency (DFEE)												32.2 (109)

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 318.1125 (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	4 * 10 =	40.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1257 (8)										
Pressure test	Yes											
Pressure Test Method	Blower Door											
Measured/design AP50		5.0000 (17)										
Infiltration rate		0.3757 (18)										
Number of sides sheltered		2 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3194 (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	0.4072	0.3992	0.3912	0.3513	0.3433	0.3034	0.3034	0.2954	0.3194	0.3433	0.3593	0.3753 (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	0.5829	0.5797	0.5765	0.5617	0.5589	0.5460	0.5460	0.5436	0.5510	0.5589	0.5645	0.5704 (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					
TER Semi-glazed door			4.0100	1.0000	4.0100		(26a)					
TER Opening Type (Uw = 1.20)			24.8000	1.1450	28.3969		(27)					
Floor 1 P/a 0.5			63.7500	0.1300	8.2875		(28a)					
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1800	23.5566		(29a)					
External Roof 1 Horz	63.7500		63.7500	0.1100	7.0125		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			287.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	71.2635	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.1080 (35)					
List of Thermal Bridges												
K1 Element				Length	Psi-value	Total						
E16 Corner (normal)				19.9600	0.0900	1.7964						
E5 Ground floor (normal)				32.0000	0.1600	5.1200						
E10 Eaves (insulation at ceiling level)				17.0000	0.0600	1.0200						
E12 Gable (insulation at ceiling level)				15.0000	0.0600	0.9000						
E6 Intermediate floor within a dwelling				32.0000	0.0000	0.0000						
E2 Other lintels (including other steel lintels)				19.2600	0.0500	0.9630						
E3 Sill				17.3500	0.0500	0.8675						
E4 Jamb				42.0000	0.0500	2.1000						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7669 (36)					
Point Thermal bridges							(36a) = 0.0000					
Total fabric heat loss							(33) + (36) + (36a) = 84.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 61.1922	Feb 60.8542	Mar 60.5230	Apr 58.9669	May 58.6758	Jun 57.3206	Jul 57.3206	Aug 57.0696	Sep 57.8426	Oct 58.6758	Nov 59.2648	Dec 59.8805 (38)
Heat transfer coeff	145.2227	144.8847	144.5534	142.9974	142.7063	141.3510	141.3510	141.1001	141.8730	142.7063	143.2952	143.9109 (39)
Average = Sum(39)m / 12 =												142.9960
HLP	Jan 1.1390	Feb 1.1364	Mar 1.1338	Apr 1.1215	May 1.1193	Jun 1.1086	Jul 1.1086	Aug 1.1067	Sep 1.1127	Oct 1.1193	Nov 1.1239	Dec 1.1287 (40)
HLP (average)												1.1215

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Days in mont	31	28	31	30	31	30	31	31	30	31	30	31
<b>4. Water heating energy requirements (kWh/year)</b>												
Assumed occupancy												2.8882 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	31.3632	30.8974	30.2414	29.0320	28.1264	27.1223	26.5799	27.2312	27.9404	29.0149	30.2492	31.2571 (42b)
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081 (42c)
Average daily hot water use (litres/day)												69.2678 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	75.5712	73.4979	71.2344	68.4174	65.9043	63.2925	62.7501	65.0091	67.3258	70.0079	72.8497	75.4652 (44)
Energy content (annual)	119.6864	104.6600	109.4846	93.6600	88.7198	77.8256	75.8909	80.4948	83.0195	95.0000	103.7878	118.1603 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1150.3897
Water storage loss:												0.0000 (46)
Total storage loss:												0.0000 (56)
If cylinder contains dedicated solar storage												0.0000 (57)
Primary loss												0.0000 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month	101.7334	88.9610	93.0619	79.6110	75.4118	66.1517	64.5072	68.4206	70.5665	80.7500	88.2196	100.4363 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h	101.7334	88.9610	93.0619	79.6110	75.4118	66.1517	64.5072	68.4206	70.5665	80.7500	88.2196	100.4363 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 977.8312 (64)
Electric shower(s)												58.1769 (64a)
Heat gains from water heating, kWh/month	39.9776	35.1993	37.4162	33.4067	32.6103	29.6611	29.6874	30.8624	31.1455	34.3383	35.9396	39.6533 (65)
<b>5. Internal gains (see Table 5 and 5a)</b>												
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101	144.4101 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.1512	166.2389	150.1512	155.1563	150.1512	155.1563	150.1512	150.1512	155.1563	150.1512	155.1563	150.1512 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.6815	297.7394	290.0336	273.6290	252.9212	233.4587	220.4566	217.3987	225.1044	241.5090	262.2169	281.6794 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410	37.4410 (69)
Pumps, fans												0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281 (71)
Water heating gains (Table 5)	53.7333	52.3799	50.2907	46.3981	43.8310	41.1959	39.9024	41.4818	43.2577	46.1536	49.9161	53.2974 (72)
Total internal gains	564.8891	582.6812	556.7986	541.5065	513.2264	496.1339	476.8332	475.3547	489.8414	504.1369	533.6123	551.4511 (73)
<b>6. Solar gains</b>												
[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							
Southeast	14.6100	36.7938	0.6300	0.7000	0.7700	164.2847 (77)						
Northwest	10.1900	11.2829	0.6300	0.7000	0.7700	35.1373 (81)						
Solar gains	199.4220	351.3606	511.7477	686.0422	815.8529	830.8154	792.3128	692.2786	571.6045	396.6869	240.9870	169.2883 (83)
Total gains	764.3111	934.0418	1068.5462	1227.5487	1329.0794	1326.9493	1269.1460	1167.6334	1061.4460	900.8238	774.5993	720.7394 (84)
<b>7. Mean internal temperature (heating season)</b>												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	24.4142	24.4711	24.5272	24.7941	24.8447	25.0829	25.0829	25.1275	24.9906	24.8447	24.7426	24.6367
alpha	2.6276	2.6314	2.6351	2.6529	2.6563	2.6722	2.6722	2.6752	2.6660	2.6563	2.6495	2.6424
util living area	0.9665	0.9440	0.9091	0.8364	0.7260	0.5785	0.4500	0.4979	0.6972	0.8756	0.9483	0.9710 (86)
MIT	18.2941	18.6700	19.1923	19.8644	20.4147	20.7779	20.9175	20.8901	20.6132	19.8766	18.9721	18.2338 (87)
Th 2	19.9691	19.9713	19.9734	19.9833	19.9851	19.9938	19.9938	19.9954	19.9905	19.9851	19.9814	19.9775 (88)
util rest of house	0.9615	0.9358	0.8954	0.8113	0.6828	0.5106	0.3600	0.4068	0.6357	0.8508	0.9393	0.9666 (89)
MIT 2	17.4972	17.8683	18.3807	19.0326	19.5410	19.8562	19.9568	19.9429	19.7299	19.0597	18.1777	17.4431 (90)
Living area fraction												fLA = Living area / (4) = 0.1104 (91)
MIT	17.5852	17.9568	18.4703	19.1244	19.6375	19.9579	20.0629	20.0475	19.8274	19.1499	18.2654	17.5305 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5852	17.9568	18.4703	19.1244	19.6375	19.9579	20.0629	20.0475	19.8274	19.1499	18.2654	17.5305 (93)

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## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9451	0.9144	0.8701	0.7863	0.6662	0.5080	0.3665	0.4118	0.6246	0.8256	0.9188	0.9517	(94)
Useful gains	722.3434	854.0466	929.7296	965.2019	885.4597	674.0926	465.1739	480.8334	662.9267	743.7098	711.6708	685.8925	(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	1929.3150	1891.7308	1730.3526	1462.0686	1132.7332	757.3514	489.4840	514.6598	812.5651	1220.1214	1599.9527	1918.3985	(97)
Space heating kWh	897.9868	697.3238	595.6636	357.7440	183.9715	0.0000	0.0000	0.0000	0.0000	354.4503	639.5630	916.9844	(98a)
Space heating requirement - total per year (kWh/year)												4643.6874	
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	897.9868	697.3238	595.6636	357.7440	183.9715	0.0000	0.0000	0.0000	0.0000	354.4503	639.5630	916.9844	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4643.6874	
Space heating per m2										(98c) / (4) =		36.4211	(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	1328.6996	1045.9976	1072.3604	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7672	0.8279	0.7953	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1019.3884	866.0098	852.8117	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1486.8437	1422.1990	1306.5478	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	336.5679	413.8048	337.5797	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	84.1420	103.4512	84.3949	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												271.9881	(107)
Energy for space heating												36.4211	(99)
Energy for space cooling												2.1332	(108)
Total												38.5543	(109)
Fabric Energy Efficiency (TFEE)												38.6	(109)

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )	
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)	
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	318.1125 (5)	

## 2. Ventilation rate

			m3 per hour										
Number of open chimneys	0 * 80 =	0.0000	(6a)										
Number of open flues	0 * 20 =	0.0000	(6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)										
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)										
Number of blocked chimneys	0 * 20 =	0.0000	(6f)										
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)										
Number of passive vents	0 * 10 =	0.0000	(7b)										
Number of flueless gas fires	0 * 40 =	0.0000	(7c)										
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test		Yes											
Pressure Test Method		Blower Door											
Measured/design AP50		1.0000	(17)										
Infiltration rate		0.0500	(18)										
Number of sides sheltered		2	(19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0425	(21)										
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.0542	0.0531	0.0521	0.0468	0.0457	0.0404	0.0404	0.0393	0.0425	0.0457	0.0478	0.0499	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000	(23c)
Effective ac	0.1492	0.1481	0.1471	0.1417	0.1407	0.1354	0.1354	0.1343	0.1375	0.1407	0.1428	0.1449	(25)

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## 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			24.8000	1.1450	28.3969			(27)
Door			4.0100	1.0000	4.0100			(26a)
Floor 1 P/a 0.5			63.7500	0.1200	7.6500	110.0000	7012.5000	(28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1500	19.6305	9.0000	1177.8300	(29a)
External Roof 1 Horz	63.7500		63.7500	0.0900	5.7375	9.0000	573.7500	(30)
Total net area of external elements Aum(A, m2)			287.1800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.4249		(33)
Internal Wall 1 GF			106.1800			9.0000	955.6200	(32c)
Internal Wall 2 FF			146.9800			9.0000	1322.8200	(32c)
Internal Floor 1			63.7500			18.0000	1147.5000	(32d)
Internal Ceiling 1			63.7500			9.0000	573.7500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12763.7700 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.1080 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E16 Corner (normal)	19.9600	0.0300	0.5988	
E5 Ground floor (normal)	32.0000	0.0210	0.6720	
E10 Eaves (insulation at ceiling level)	17.0000	0.0440	0.7480	
E12 Gable (insulation at ceiling level)	15.0000	0.0510	0.7650	
E6 Intermediate floor within a dwelling	32.0000	0.0800	2.5600	
E2 Other lintels (including other steel lintels)	19.2600	0.0840	1.6178	
E3 Sill	17.3500	0.0430	0.7460	
E4 Jamb	42.0000	0.0340	1.4280	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1357 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 74.5606 (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	15.6613	15.5497	15.4382	14.8805	14.7690	14.2113	14.2113	14.0997	14.4344	14.7690	14.9920	15.2151	(38)
Average = Sum(39)m / 12 =	90.2219	90.1104	89.9988	89.4411	89.3296	88.7719	88.7719	88.6604	88.9950	89.3296	89.5527	89.7758	(39)
HLP	0.7076	0.7067	0.7059	0.7015	0.7006	0.6963	0.6963	0.6954	0.6980	0.7006	0.7024	0.7041	(40)
HLP (average)												0.7013	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy 2.8882 (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 83.7993 82.5548 80.8022 77.5708 75.1511 72.4681 71.0189 72.7592 74.6541 77.5250 80.8230 83.5160 (42b)

Hot water usage for other uses 44.2081 42.6005 40.9930 39.3854 37.7778 36.1703 36.1703 37.7778 39.3854 40.9930 42.6005 44.2081 (42c)

Average daily hot water use (litres/day) 117.8843 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	128.0074	125.1553	121.7952	116.9562	112.9289	108.6384	107.1891	110.5370	114.0395	118.5179	123.4235	127.7241	(44)
Energy content (annual)	202.7324	178.2195	187.1946	160.1071	152.0241	133.5836	129.6360	136.8679	140.6221	160.8277	175.8394	199.9851	(45)
Distribution loss (46)m = 0.15 x (45)m	30.4099	26.7329	28.0792	24.0161	22.8036	20.0375	19.4454	20.5302	21.0933	24.1242	26.3759	29.9978	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315	(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	107.4457	95.4205	102.2793	91.9812	90.5851	83.1621	83.1411	85.5457	85.5024	93.5123	97.2122	106.5322	(65)

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

Metabolic gains (Table 5), Watts

(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.1664	29.4581	23.9569	18.1369	13.5576	11.4459	12.3677	16.0760	21.5771	27.3971	31.9765	34.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.8231	444.3871	432.8860	408.4015	377.4943	348.4458	329.0396	324.4757	335.9768	360.4612	391.3685	420.4170	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

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-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	(71)
Water heating gains (Table 5)												
144.4162	141.9948	137.4722	127.7517	121.7542	115.5030	111.7488	114.9808	118.7534	125.6886	135.0169	143.1884	(72)
Total internal gains												
730.3872	728.8215	707.2967	667.2717	625.7875	588.3761	566.1376	568.5139	589.2887	626.5285	671.3434	710.6750	(73)

## 6. Solar gains

[Jan]												Gains W
	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d					
Southeast	14.6100	36.7938	0.7600		0.7000		0.7700		198.1847 (77)			
Northwest	10.1900	11.2829	0.7600		0.7000		0.7700		42.3878 (81)			
Solar gains	240.5725	423.8636	617.3464	827.6064	984.2036	1002.2534	955.8059	835.1298	689.5547	478.5429	290.7145	204.2209 (83)
Total gains	970.9597	1152.6851	1324.6430	1494.8781	1609.9911	1590.6296	1521.9434	1403.6437	1278.8434	1105.0714	962.0579	914.8959 (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	39.2975	39.3461	39.3949	39.6405	39.6900	39.9393	39.9393	39.9896	39.8392	39.6900	39.5911	39.4928
alpha	3.6198	3.6231	3.6263	3.6427	3.6460	3.6626	3.6626	3.6660	3.6559	3.6460	3.6394	3.6329
util living area	0.9166	0.8636	0.7779	0.6446	0.4925	0.3518	0.2553	0.2883	0.4625	0.7122	0.8725	0.9290 (86)
Living	20.0418	20.2702	20.5262	20.7471	20.8618	20.9038	20.9130	20.9115	20.8836	20.7138	20.3402	19.9819
Non living	19.1981	19.4800	19.7906	20.0525	20.1799	20.2263	20.2343	20.2341	20.2066	20.0216	19.5745	19.1262
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	20.5098	20.2702	20.5262	20.7471	20.8618	20.9038	20.9130	20.9115	20.8836	20.7138	20.3402	20.1243 (87)
Th 2	20.3341	20.3349	20.3356	20.3395	20.3403	20.3441	20.3441	20.3449	20.3426	20.3403	20.3387	20.3372 (88)
util rest of house	0.9077	0.8506	0.7590	0.6189	0.4617	0.3172	0.2177	0.2480	0.4225	0.6830	0.8580	0.9213 (89)
MIT 2	19.8812	19.4800	19.7906	20.0525	20.1799	20.2263	20.2343	20.2341	20.2066	20.0216	19.5745	19.3444 (90)
Living area fraction	FLA = Living area / (4) =											0.1104 (91)
MIT	19.9506	19.5673	19.8719	20.1292	20.2552	20.3011	20.3093	20.3089	20.2814	20.0980	19.6590	19.4305 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9506	19.5673	19.8719	20.1292	20.2552	20.3011	20.3093	20.3089	20.2814	20.0980	19.6590	19.4305 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9021	0.8338	0.7448	0.6104	0.4577	0.3149	0.2157	0.2458	0.4187	0.6716	0.8411	0.9090 (94)
Useful gains	875.9286	961.1380	986.5596	912.4420	736.8415	500.8688	328.3318	345.0124	535.4773	742.1240	809.2016	831.6271 (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	1412.0286	1321.6717	1203.4527	1004.3518	764.2358	506.0981	329.2802	346.5622	550.1134	848.4560	1124.6934	1367.3327 (97)
Space heating kWh	398.8585	242.2787	161.3685	66.1750	20.3814	0.0000	0.0000	0.0000	0.0000	79.1110	227.1541	398.5649 (98a)
Space heating requirement - total per year (kWh/year)												1593.8921
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	398.8585	242.2787	161.3685	66.1750	20.3814	0.0000	0.0000	0.0000	0.0000	79.1110	227.1541	398.5649 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1593.8921
Space heating per m2												(98c) / (4) = 12.5011 (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	398.8585	242.2787	161.3685	66.1750	20.3814	0.0000	0.0000	0.0000	0.0000	79.1110	227.1541	398.5649 (98)
Space heating efficiency (main heating system 1)	383.6065	383.6065	383.6065	383.6065	383.6065	0.0000	0.0000	0.0000	0.0000	383.6065	383.6065	383.6065 (210)
Space heating fuel (main heating system)	103.9759	63.1581	42.0661	17.2508	5.3131	0.0000	0.0000	0.0000	0.0000	20.6230	59.2154	103.8994 (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												0.0000 (201)
Water heating requirement	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315 (64)
Efficiency of water heater (217)m	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825 (216)
Fuel for water heating, kWh/month	125.1489	110.6149	117.4562	103.2462	100.0436	90.1145	88.9594	92.5399	93.5992	104.4022	111.0351	123.7887 (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	27.5560	24.8893	27.5560	26.6671	27.5560	26.6671	27.5560	27.5560	26.6671	27.5560	26.6671	27.5560 (231)
Lighting	29.0303	23.2892	20.9694	15.3631	11.8669	9.6953	10.8254	14.0712	18.2771	23.9805	27.0860	29.8372 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-55.5867	-81.7599	-122.3216	-140.6948	-153.7352	-143.8541	-141.9387	-132.8215	-115.5436	-94.1595	-61.7729	-47.4704 (233a)



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Ground floor	Area (m2)	Storey height (m)	Volume (m3)
First floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Dwelling volume	127.5000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 318.1125 (5)

## 2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			1.0000 (17)
Infiltration rate			0.0500 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0425	(21)

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

## 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)			24.8000	1.1450	28.3969		(27)
Door			4.0100	1.0000	4.0100		(26a)
Floor 1 P/a 0.5			63.7500	0.1200	7.6500	110.0000	7012.5000 (28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1500	19.6305	9.0000	1177.8300 (29a)
External Roof 1 Horz	63.7500		63.7500	0.0900	5.7375	9.0000	573.7500 (30)
Total net area of external elements Aum(A, m2)			287.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4249		(33)
Internal Wall 1 GF			106.1800			9.0000	955.6200 (32c)
Internal Wall 2 FF			146.9800			9.0000	1322.8200 (32c)
Internal Floor 1			63.7500			18.0000	1147.5000 (32d)
Internal Ceiling 1			63.7500			9.0000	573.7500 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	12763.7700		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.1080 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E16 Corner (normal)				19.9600	0.0300	0.5988	
E5 Ground floor (normal)				32.0000	0.0210	0.6720	
E10 Eaves (insulation at ceiling level)				17.0000	0.0440	0.7480	
E12 Gable (insulation at ceiling level)				15.0000	0.0510	0.7650	
E6 Intermediate floor within a dwelling				32.0000	0.0800	2.5600	
E2 Other lintels (including other steel lintels)				19.2600	0.0840	1.6178	
E3 Sill				17.3500	0.0430	0.7460	
E4 Jamb				42.0000	0.0340	1.4280	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1357 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 74.5606 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	17.3343	16.8882	16.7767	16.2190	16.1074	15.2151	15.1036	14.9920	15.5497	16.4420	16.6651	17.2228
Heat transfer coeff	91.8950	91.4488	91.3373	90.7796	90.6681	89.7758	89.6642	89.5527	90.1104	91.0027	91.2258	91.7834
Average = Sum(39)m / 12 =												
HLP (average)	0.7207	0.7172	0.7164	0.7120	0.7111	0.7041	0.7032	0.7024	0.7067	0.7137	0.7155	0.7199
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy												2.8882 (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
Hot water usage for baths	83.7993	82.5548	80.8022	77.5708	75.1511	72.4681	71.0189	72.7592	74.6541	77.5250	80.8230	83.5160
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081
Average daily hot water use (litres/day)												117.8843 (43)



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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.0074	125.1553	121.7952	116.9562	112.9289	108.6384	107.1891	110.5370	114.0395	118.5179	123.4235	127.7241	(44)
Energy content (annual)	202.7324	178.2195	187.1946	160.1071	152.0241	133.5836	129.6360	136.8679	140.6221	160.8277	175.8394	199.9851	(45)
Distribution loss (46)m = 0.15 x (45)m	30.4099	26.7329	28.0792	24.0161	22.8036	20.0375	19.4454	20.5302	21.0933	24.1242	26.3759	29.9978	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8640 (55)
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315	(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	107.4457	95.4205	102.2793	91.9812	90.5851	83.1621	83.1411	85.5457	85.5024	93.5123	97.2122	106.5322	(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	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.1664	29.4581	23.9569	18.1369	13.5576	11.4459	12.3677	16.0760	21.5771	27.3971	31.9765	34.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.8231	444.3871	432.8860	408.4015	377.4943	348.4458	329.0396	324.4757	335.9768	360.4612	391.3685	420.4170	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	(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)	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	(71)
Water heating gains (Table 5)	144.4162	141.9948	137.4722	127.7517	121.7542	115.5030	111.7488	114.9808	118.7534	125.6886	135.0169	143.1884	(72)
Total internal gains	730.3872	728.8215	707.2967	667.2717	625.7875	588.3761	566.1376	568.5139	589.2887	626.5285	671.3434	710.6750	(73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
Southeast	14.6100	48.0626	0.7600	0.7000	0.7700	258.8823 (77)							
Northwest	10.1900	15.8649	0.7600	0.7000	0.7700	59.6013 (81)							
Solar gains	318.4836	484.8880	702.2978	972.2588	1102.0334	1226.5441	1055.7376	989.9457	826.2962	565.9125	369.2973	262.0792	(83)
Total gains	1048.8708	1213.7095	1409.5945	1639.5305	1727.8209	1814.9202	1621.8752	1558.4596	1415.5849	1192.4410	1040.6407	972.7542	(84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.8533	0.7941	0.7073	0.5808	0.4551	0.3180	0.2638	0.2684	0.3863	0.5984	0.7750	0.8626	(86)
Living	20.3624	20.5065	20.6584	20.7977	20.8726	20.9060	20.9116	20.9116	20.8982	20.8168	20.6104	20.3634	
Non living	19.5866	19.7609	19.9388	20.0997	20.1815	20.2209	20.2267	20.2276	20.2122	20.1247	19.8909	19.5906	
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	20.6738	20.5065	20.6584	20.7977	20.8726	20.9060	20.9116	20.9116	20.8982	20.8168	20.6104	20.4525	(87)
Th 2	20.3225	20.3256	20.3264	20.3302	20.3310	20.3372	20.3380	20.3387	20.3349	20.3287	20.3272	20.3233	(88)
util rest of house	0.8373	0.7745	0.6835	0.5535	0.4245	0.2865	0.2279	0.2312	0.3471	0.5616	0.7498	0.8466	(89)
MIT 2	20.0292	19.7609	19.9388	20.0997	20.1815	20.2209	20.2267	20.2276	20.2122	20.1247	19.8909	19.7226	(90)
Living area fraction									fLA = Living area / (4) =			0.1104	(91)
MIT	20.1004	19.8432	20.0183	20.1768	20.2578	20.2965	20.3024	20.3031	20.2880	20.2011	19.9704	19.8032	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1004	19.8432	20.0183	20.1768	20.2578	20.2965	20.3024	20.3031	20.2880	20.2011	19.9704	19.8032	(93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	872.3139	921.5548	947.3351	896.9234	727.4878	516.4062	366.5440	357.1746	487.3430	660.9387	765.1424	810.2078	(95)
Ext temp.	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000	(96)
Heat loss rate W	1203.8565	1147.0621	1088.5818	960.1586	748.7203	520.3871	367.8365	358.4889	494.5221	709.9240	927.7990	1120.0514	(97)

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Space heating kWh	246.6677	151.5410	105.0876	45.5294	15.7970	0.0000	0.0000	0.0000	0.0000	36.4451	117.1127	230.5236 (98a)
Space heating requirement - total per year (kWh/year)												948.7040
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	246.6677	151.5410	105.0876	45.5294	15.7970	0.0000	0.0000	0.0000	0.0000	36.4451	117.1127	230.5236 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												948.7040
Space heating per m2												(98c) / (4) = 7.4408 (99)

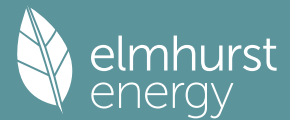
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												382.3191 (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	246.6677	151.5410	105.0876	45.5294	15.7970	0.0000	0.0000	0.0000	0.0000	36.4451	117.1127	230.5236 (98)
Space heating efficiency (main heating system 1)	382.3191	382.3191	382.3191	382.3191	382.3191	0.0000	0.0000	0.0000	0.0000	382.3191	382.3191	382.3191 (210)
Space heating fuel (main heating system)	64.5188	39.6373	27.4869	11.9087	4.1319	0.0000	0.0000	0.0000	0.0000	9.5326	30.6322	60.2961 (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	252.7788	223.4227	237.2410	208.5391	202.0705	182.0156	179.6824	186.9143	189.0541	210.8741	224.2714	250.0315 (64)
Efficiency of water heater	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703	201.7703 (216)
Fuel for water heating, kWh/month	125.2805	110.7312	117.5798	103.3547	100.1488	90.2093	89.0529	92.6372	93.6977	104.5120	111.1518	123.9189 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	27.5560	24.8893	27.5560	26.6671	27.5560	26.6671	27.5560	26.6671	26.6671	27.5560	26.6671	27.5560 (231)
Lighting	29.0303	23.2892	20.9694	15.3631	11.8669	9.6953	10.8254	14.0712	18.2771	23.9805	27.0860	29.8372 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-70.4842	-90.9982	-133.4223	-153.6207	-162.2478	-157.1322	-148.5447	-144.6948	-128.8582	-106.2561	-74.9437	-58.9794 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-38.0406	-69.3332	-145.2741	-238.4701	-302.6013	-343.4697	-296.9015	-271.0208	-196.3891	-107.9408	-49.4979	-28.3826 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												248.1446 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												201.7703
Water heating fuel used												1262.2748 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)												
mechanical ventilation fans (SFP = 0.8360)												324.4493 (230a)
Total electricity for the above, kWh/year												324.4493 (231)
Electricity for lighting (calculated in Appendix L)												234.2915 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-3517.5040 (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												-1448.3438 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	248.1446	25.1600	62.4332 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1262.2748	25.1600	317.5883 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	324.4493	25.1600	81.6314 (249)
Energy for lighting	234.2915	25.1600	58.9477 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1430.1823	25.1600	-359.8339
PV Unit electricity exported	-2087.3217	5.8100	-121.2734
Total			-481.1073 (252)
Total energy cost			39.4934 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	248.1446	0.1574	39.0626 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1262.2748	0.1409	177.8396 (264)
Space and water heating			216.9021 (265)
Pumps, fans and electric keep-hot	324.4493	0.1387	45.0051 (267)
Energy for lighting	234.2915	0.1443	33.8155 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1430.1823	0.1346	-192.4985
PV Unit electricity exported	-2087.3217	0.1250	-260.9565
Total			-453.4551 (269)
Total CO2, kg/year			-157.7323 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	248.1446	1.5827	392.7423 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1262.2748	1.5210	1919.8602 (278)
Space and water heating			2312.6025 (279)
Pumps, fans and electric keep-hot	324.4493	1.5128	490.8269 (281)
Energy for lighting	234.2915	1.5338	359.3642 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1430.1823	1.4974	-2141.6034
PV Unit electricity exported	-2087.3217	0.4589	-957.8594
Total			-3099.4627 (283)
Total Primary energy kWh/year			63.3308 (286)

## SAP 10 EPC IMPROVEMENTS

SEC1 - ASHP ROI TF 0.15 improv

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

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

Recommended measures:  
 N Solar water heating SAP change + 1.3 Cost change -£ 72 CO2 change -42 kg (26.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£72	0.33 kg/m <sup>2</sup>	A 99
<b>Total Savings</b>	<b>£72</b>	<b>0.33 kg/m<sup>2</sup></b>	<b>A 101</b>

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

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

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

	Current	Potential	Saving
Electricity	£521	£436	£85
Space heating	£144	£164	-£20
Water heating	£318	£212	£105
Lighting	£59	£59	£0
Generated (PV)	-£481	-£468	-£13
Total cost of fuels	£40	-£32	£72
Total cost of uses	£40	-£33	£72
Delivered energy	-11 kWh/m <sup>2</sup>	-14 kWh/m <sup>2</sup>	3 kWh/m <sup>2</sup>
Carbon dioxide emissions	-0.2 tonnes	-0.2 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	-1 kg/m <sup>2</sup>	-2 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	0 kWh/m <sup>2</sup>	-3 kWh/m <sup>2</sup>	3 kWh/m <sup>2</sup>

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 318.1125 (5)





# Full SAP Calculation Printout



## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9021	0.8338	0.7452	0.6126	0.4611	0.3176	0.2177	0.2481	0.4205	0.6721	0.8411	0.9090	(94)
Useful gains	875.9286	961.1380	986.0346	911.1641	736.0545	500.6933	328.2963	344.9549	535.2382	741.7631	809.2016	831.6271	(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	1412.0286	1321.6717	1203.3687	1004.1570	764.1199	506.0724	329.2748	346.5536	550.0780	848.3997	1124.6934	1367.3327	(97)
Space heating kWh	398.8585	242.2787	161.6966	66.9549	20.8807	0.0000	0.0000	0.0000	0.0000	79.3376	227.1541	398.5649	(98a)
Space heating requirement - total per year (kWh/year)												1595.7259	
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	398.8585	242.2787	161.6966	66.9549	20.8807	0.0000	0.0000	0.0000	0.0000	79.3376	227.1541	398.5649	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1595.7259	
Space heating per m2												12.5155	(99)

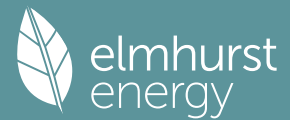
## 9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)														383.6065	(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	398.8585	242.2787	161.6966	66.9549	20.8807	0.0000	0.0000	0.0000	0.0000	79.3376	227.1541	398.5649	(98)		
Space heating efficiency (main heating system 1)	383.6065	383.6065	383.6065	383.6065	383.6065	0.0000	0.0000	0.0000	0.0000	383.6065	383.6065	383.6065	(210)		
Space heating fuel (main heating system)	103.9759	63.1581	42.1517	17.4541	5.4432	0.0000	0.0000	0.0000	0.0000	20.6820	59.2154	103.8994	(211)		
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)		
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)		
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)		
Water heating															
Water heating requirement	252.7788	207.1972	178.0180	122.7460	86.7398	75.0151	72.9794	92.5461	126.4976	180.8739	224.2714	250.0315	(64)		
Efficiency of water heater (217)m	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	201.9825	(216)		
Fuel for water heating, kWh/month	125.1489	102.5818	88.1353	60.7706	42.9442	37.1394	36.1316	45.8189	62.6280	89.5493	111.0351	123.7887	(219)		
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)		
Pumps and Fa	34.3505	31.0262	34.3505	33.2424	34.3505	33.2424	34.3505	34.3505	33.2424	34.3505	33.2424	34.3505	(231)		
Lighting	29.0303	23.2892	20.9694	15.3631	11.8669	9.6953	10.8254	14.0712	18.2771	23.9805	27.0860	29.8372	(232)		
Electricity generated by PVs (Appendix M) (negative quantity)	-55.6947	-81.6847	-120.5596	-135.8825	-144.4070	-134.2807	-132.4713	-125.8271	-112.4139	-93.6334	-61.9416	-47.5573	(233a)		
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)		
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)		
Electricity generated by PVs (Appendix M) (negative quantity)	-23.6520	-54.3395	-119.1481	-194.4941	-269.7798	-274.9345	-270.5240	-222.6124	-154.3842	-82.5945	-32.9257	-18.3152	(233b)		
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)		
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)		
Annual totals kWh/year															
Space heating fuel - main system 1													415.9799	(211)	
Space heating fuel - main system 2													0.0000	(213)	
Space heating fuel - secondary													0.0000	(215)	
Efficiency of water heater													201.9825		
Water heating fuel used													925.6717	(219)	
Space cooling fuel													0.0000	(221)	
Electricity for pumps and fans:															
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.8360)															
mechanical ventilation fans (SFP = 0.8360)													324.4493	(230a)	
pump for solar water heating													80.0000	(230g)	
Total electricity for the above, kWh/year													404.4493	(231)	
Electricity for lighting (calculated in Appendix L)													234.2915	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation													-2964.0577	(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													-983.6653	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	415.9799	16.4900	68.5951
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	925.6717	16.4900	152.6433
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000
Pumps, fans and electric keep-hot	324.4493	16.4900	53.5017
Pump for solar water heating	80.0000	16.4900	13.1920
Energy for lighting	234.2915	16.4900	38.6347
Additional standing charges			0.0000

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.3538	16.4900	-205.5237
PV Unit electricity exported	-1717.7039	5.5900	-96.0197
Total			-301.5434 (252)
Total energy cost			25.0233 (255)

-----  
 11a. SAP rating - Individual heating systems  
 -----

Energy cost deflator (Table 12):			0.3600 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.0522 (257)
SAP value			99.1535
SAP rating (Section 12)			99 (258)
SAP band			A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	415.9799	0.1572	65.4069 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	925.6717	0.1459	135.0181 (264)
Space and water heating			200.4250 (265)
Pumps, fans and electric keep-hot	404.4493	0.1387	56.1021 (267)
Energy for lighting	234.2915	0.1443	33.8155 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1246.3538	0.1344	-167.5506
PV Unit electricity exported	-1717.7039	0.1238	-212.6575
Total			-380.2081 (269)
Total CO2, kg/year			-89.8654 (272)
CO2 emissions per m2			-0.7000 (273)
EI value			100.6981
EI rating			101 (274)
EI band			A

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 SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING  
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-----  
 1. Overall dwelling characteristics  
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	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	63.7500 (1b)	x 2.3700 (2b)	= 151.0875 (1b) - (3b)
First floor	63.7500 (1c)	x 2.6200 (2c)	= 167.0250 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	318.1125 (5)

-----  
 2. Ventilation rate  
 -----

	m3 per hour											
Number of open chimneys	0 * 80 =	0.0000 (6a)										
Number of open flues	0 * 20 =	0.0000 (6b)										
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)										
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)										
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)										
Number of blocked chimneys	0 * 20 =	0.0000 (6f)										
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)										
Number of passive vents	0 * 10 =	0.0000 (7b)										
Number of flueless gas fires	0 * 40 =	0.0000 (7c)										
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)										
Pressure test		Yes										
Pressure Test Method		Blower Door										
Measured/design AP50		1.0000 (17)										
Infiltration rate		0.0500 (18)										
Number of sides sheltered		2 (19)										
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)										
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0425 (21)										
Wind speed	Jan 6.6000	Feb 6.2000	Mar 6.1000	Apr 5.6000	May 5.5000	Jun 4.7000	Jul 4.6000	Aug 4.5000	Sep 5.0000	Oct 5.8000	Nov 6.0000	Dec 6.5000 (22)
Wind factor	1.6500	1.5500	1.5250	1.4000	1.3750	1.1750	1.1500	1.1250	1.2500	1.4500	1.5000	1.6250 (22a)
Adj infilt rate	0.0701	0.0659	0.0648	0.0595	0.0584	0.0499	0.0489	0.0478	0.0531	0.0616	0.0638	0.0691 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.1651	0.1609	0.1598	0.1545	0.1534	0.1449	0.1439	0.1428	0.1481	0.1566	0.1587	0.1641 (25)

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### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			24.8000	1.1450	28.3969			(27)
Door			4.0100	1.0000	4.0100			(26a)
Floor 1 P/a 0.5			63.7500	0.1200	7.6500	110.0000	7012.5000	(28a)
External Wall 1 Stone	159.6800	28.8100	130.8700	0.1500	19.6305	9.0000	1177.8300	(29a)
External Roof 1 Horz	63.7500		63.7500	0.0900	5.7375	9.0000	573.7500	(30)
Total net area of external elements Aum(A, m2)			287.1800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	65.4249		(33)
Internal Wall 1 GF			106.1800			9.0000	955.6200	(32c)
Internal Wall 2 FF			146.9800			9.0000	1322.8200	(32c)
Internal Floor 1			63.7500			18.0000	1147.5000	(32d)
Internal Ceiling 1			63.7500			9.0000	573.7500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12763.7700 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.1080 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E16 Corner (normal)	19.9600	0.0300	0.5988
E5 Ground floor (normal)	32.0000	0.0210	0.6720
E10 Eaves (insulation at ceiling level)	17.0000	0.0440	0.7480
E12 Gable (insulation at ceiling level)	15.0000	0.0510	0.7650
E6 Intermediate floor within a dwelling	32.0000	0.0800	2.5600
E2 Other lintels (including other steel lintels)	19.2600	0.0840	1.6178
E3 Sill	17.3500	0.0430	0.7460
E4 Jamb	42.0000	0.0340	1.4280

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1357 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 74.5606 (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	17.3343	16.8882	16.7767	16.2190	16.1074	15.2151	15.1036	14.9920	15.5497	16.4420	16.6651	17.2228
Average = Sum(39)m / 12 =	91.8950	91.4488	91.3373	90.7796	90.6681	89.7758	89.6642	89.5527	90.1104	91.0027	91.2258	91.7834

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.7207	0.7172	0.7164	0.7120	0.7111	0.7041	0.7032	0.7024	0.7067	0.7137	0.7155	0.7199
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													2.8882 (42)	
Hot water usage for mixer showers														0.0000 (42a)
Hot water usage for baths	83.7993	82.5548	80.8022	77.5708	75.1511	72.4681	71.0189	72.7592	74.6541	77.5250	80.8230	83.5160	83.5160 (42b)	
Hot water usage for other uses	44.2081	42.6005	40.9930	39.3854	37.7778	36.1703	36.1703	37.7778	39.3854	40.9930	42.6005	44.2081	44.2081 (42c)	
Average daily hot water use (litres/day)													117.8843 (43)	
Daily hot water use	128.0074	125.1553	121.7952	116.9562	112.9289	108.6384	107.1891	110.5370	114.0395	118.5179	123.4235	127.7241	127.7241 (44)	
Energy conte	202.7324	178.2195	187.1946	160.1071	152.0241	133.5836	129.6360	136.8679	140.6221	160.8277	175.8394	199.9851	199.9851 (45)	
Energy content (annual)													Total = Sum(45)m = 1957.6394	
Distribution loss (46)m = 0.15 x (45)m	30.4099	26.7329	28.0792	24.0161	22.8036	20.0375	19.4454	20.5302	21.0933	24.1242	26.3759	29.9978	29.9978 (46)	
Water storage loss:														
Store volume													250.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.6000 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													0.8640 (55)	
Total storage loss	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840 (56)	
If cylinder contains dedicated solar storage	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840 (57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	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	252.7788	223.4227	235.8453	201.7855	189.2762	169.4088	166.6554	174.8179	183.6512	209.4784	224.2714	250.0315	250.0315 (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)	
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-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													778.2133 (H24)	
Heat delivered to space heating													0.0000 (H29)	
Solar input													778.2133	
Solar input	-9.4949	-28.0186	-73.6468	-97.9041	-115.8856	-115.6833	-103.4612	-100.2188	-75.8956	-45.0794	-12.9249	-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 (64a)	
Output from w/h	243.2839	195.4041	162.1984	103.8815	73.3906	53.7255	63.1942	74.5990	107.7556	164.3990	211.3465	250.0315	250.0315 (64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)	
Heat gains from water heating, kWh/month	107.4457	95.4205	101.1627	86.5783	80.3497	73.0768	72.7195	75.8685	81.1801	92.3957	97.2122	106.5322	106.5322 (65)	



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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	173.2922	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.1664	29.4581	23.9569	18.1369	13.5576	11.4459	12.3677	16.0760	21.5771	27.3971	31.9765	34.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.8231	444.3871	432.8860	408.4015	377.4943	348.4458	329.0396	324.4757	335.9768	360.4612	391.3685	420.4170	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	55.2174	(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)	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	-115.5281	(71)
Water heating gains (Table 5)	144.4162	141.9948	135.9714	120.2477	107.9969	101.4955	97.7413	101.9739	112.7502	124.1878	135.0169	143.1884	(72)
Total internal gains	730.3872	728.8215	705.7959	659.7677	612.0302	574.3686	552.1301	555.5070	583.2855	625.0277	671.3434	710.6750	(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					
Southeast	14.6100	48.0626	0.7600	0.7000	0.7700	258.8823	(77)						
Northwest	10.1900	15.8649	0.7600	0.7000	0.7700	59.6013	(81)						
Solar gains	318.4836	484.8880	702.2978	972.2588	1102.0334	1226.5441	1055.7376	989.9457	826.2962	565.9125	369.2973	262.0792	(83)
Total gains	1048.8708	1213.7095	1408.0937	1632.0265	1714.0636	1800.9127	1607.8677	1545.4527	1409.5817	1190.9402	1040.6407	972.7542	(84)

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	38.5820	38.7702	38.8176	39.0560	39.1041	39.4928	39.5419	39.5911	39.3461	38.9603	38.8650	38.6289	21.0000 (85)
util living area	0.8533	0.7941	0.7077	0.5829	0.4583	0.3204	0.2660	0.2706	0.3879	0.5989	0.7750	0.8626	(86)
Living	20.3624	20.5065	20.6578	20.7963	20.8716	20.9058	20.9115	20.9115	20.8980	20.8165	20.6104	20.3634	
Non living	19.5866	19.7609	19.9382	20.0983	20.1806	20.2207	20.2267	20.2120	20.1244	20.1244	19.8909	19.5906	
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	20.6738	20.5065	20.6578	20.7963	20.8716	20.9058	20.9115	20.9115	20.8980	20.8165	20.6104	20.4525	(87)
Th 2	20.3225	20.3256	20.3264	20.3302	20.3310	20.3372	20.3380	20.3387	20.3349	20.3287	20.3272	20.3233	(88)
util rest of house	0.8373	0.7745	0.6840	0.5556	0.4276	0.2886	0.2299	0.2331	0.3485	0.5621	0.7498	0.8466	(89)
MIT 2	20.0292	19.7609	19.9382	20.0983	20.1806	20.2207	20.2267	20.2275	20.2120	20.1244	19.8909	19.7226	(90)
Living area fraction	20.1004	19.8432	20.0176	20.1754	20.2569	20.2963	20.3023	20.3030	20.2878	20.2008	19.9704	19.8032	(91)
MIT	20.1004	19.8432	20.0176	20.1754	20.2569	20.2963	20.3023	20.3030	20.2878	20.2008	19.9704	19.8032	(92)
Temperature adjustment	20.1004	19.8432	20.0176	20.1754	20.2569	20.2963	20.3023	20.3030	20.2878	20.2008	19.9704	19.8032	(93)
adjusted MIT	20.1004	19.8432	20.0176	20.1754	20.2569	20.2963	20.3023	20.3030	20.2878	20.2008	19.9704	19.8032	(93)

## 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8317	0.7593	0.6725	0.5490	0.4241	0.2867	0.2279	0.2311	0.3457	0.5548	0.7353	0.8329	(94)
Ext temp.	872.3139	921.5548	946.9677	896.0608	726.9070	516.2881	366.4993	357.1307	487.2316	660.7577	765.1424	810.2078	(95)
Heat loss rate W	7.0000	7.3000	8.1000	9.6000	12.0000	14.5000	16.2000	16.3000	14.8000	12.4000	9.8000	7.6000	(96)
Space heating kWh	1203.8565	1147.0621	1088.5238	960.0281	748.6343	520.3697	367.8297	358.4822	494.5055	709.8963	927.7990	1120.0514	(97)
Space heating requirement - total per year (kWh/year)	246.6677	151.5410	105.3177	46.0564	16.1651	0.0000	0.0000	0.0000	0.0000	36.5591	117.1127	230.5236	(98a)
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Space heating contribution - total per year (kWh/year)	246.6677	151.5410	105.3177	46.0564	16.1651	0.0000	0.0000	0.0000	0.0000	36.5591	117.1127	230.5236	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	246.6677	151.5410	105.3177	46.0564	16.1651	0.0000	0.0000	0.0000	0.0000	36.5591	117.1127	230.5236	(98c)
Space heating per m <sup>2</sup>													(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of main space heating system 1 (in %)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(201)
Efficiency of main space heating system 2 (in %)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(202)
Efficiency of secondary/supplementary heating system, %	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	(206)
Space heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(207)
Space heating efficiency (main heating system 1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(208)
Space heating fuel (main heating system)	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	382.3191	(210)
Space heating efficiency (main heating system 2)	64.5188	39.6373	27.5471	12.0466	4.2282	0.0000	0.0000	0.0000	0.0000	9.5625	30.6322	60.2961	(211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)



Total  
Total Primary energy kWh/year

-3031.5780 (283)  
-364.1257 (286)