

# Full SAP Calculation Printout



Property Reference	P23972(1)		Issued on Date	16/10/2023	
Assessment Reference	P23972(1)	Prop Type Ref			
Property	Flat 1, The Western, 205 High Street, Rickmansworth, WD3 1BB				
SAP Rating	95 A	DER	1.30	TER	15.62
Environmental	99 A	% DER < TER			91.68
CO <sub>2</sub> Emissions (t/year)	0.05	DFEE	25.49	TFEE	39.85
Compliance Check	See BREL	% DFEE < TFEE			36.03
% DPER < TPER	78.27	DPER	17.98	TPER	82.75
Assessor Details	Mr. Malcolm Lisle			Assessor ID	P736-0001
Client	SC, Sasha Archibald				

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	49.8400 (1b)	2.4000 (2b)	119.6160 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400		
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (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		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0463 (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	0.0590	0.0578	0.0567	0.0509	0.0497	0.0439	0.0439	0.0428	0.0463	0.0497	0.0520	0.0543 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.1495	0.1483	0.1472	0.1414	0.1402	0.1344	0.1344	0.1333	0.1367	0.1402	0.1425	0.1448 (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
Windows/Doors (U <sub>w</sub> = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)

# Full SAP Calculation Printout



Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000	(29a)
Total net area of external elements Aum(A, m2)			114.2800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	23.1881				(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000	(32)
Party Ceiling			49.8400			20.0000	996.8000	(32b)
Internal Walls			75.8400			9.0000	682.5600	(32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12246.1600 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 245.7095 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3250 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 26.5130 (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	5.9000	5.8544	5.8087	5.5805	5.5349	5.3067	5.3067	5.2610	5.3980	5.5349	5.6262	5.7175
Heat transfer coeff	32.4130	32.3674	32.3218	32.0936	32.0479	31.8197	31.8197	31.7741	31.9110	32.0479	32.1392	32.2305
Average = Sum(39)m / 12 =												32.0822

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6503	0.6494	0.6485	0.6439	0.6430	0.6384	0.6384	0.6375	0.6403	0.6430	0.6448	0.6467
HLP (average)												0.6437
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													1.6854	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	63.6313	62.6863	61.3555	58.9018	57.0645	55.0272	53.9268	55.2482	56.6871	58.8670	61.3713	63.4162	63.4162	(42b)
Hot water usage for other uses	33.5685	32.3478	31.1272	29.9065	28.6858	27.4652	27.4652	28.6858	29.9065	31.1272	32.3478	33.5685	33.5685	(42c)
Average daily hot water use (litres/day)													89.5131	(43)
Daily hot water use	97.1998	95.0341	92.4827	88.8083	85.7503	82.4924	81.3919	83.9341	86.5936	89.9942	93.7191	96.9847	96.9847	(44)
Energy conte	153.9408	135.3274	142.1425	121.5741	115.4364	101.4340	98.4365	103.9279	106.7785	122.1213	133.5201	151.8546	151.8546	(45)
Energy content (annual)													1486.4939	
Distribution loss (46)m = 0.15 x (45)m	23.0911	20.2991	21.3214	18.2361	17.3155	15.2151	14.7655	15.5892	16.0168	18.3182	20.0280	22.7782	22.7782	(46)
Water storage loss:														
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600	(48)
Temperature factor from Table 2b													0.7800	(49)
Enter (49) or (54) in (55)													1.4508	(55)
Total storage loss	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	(56)
If cylinder contains dedicated solar storage	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	54.8576	(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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	251.6870	(62)
MWHR	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHR	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	251.6870	(64)
Total per year (kWh/year) = Sum(64)m =													2537.5975	(64)
12Total per year (kWh/year)													2538	(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	95.0714	84.6354	91.1484	82.8938	82.2687	51.7364	51.3400	53.1659	53.5135	84.4914	86.8658	94.3777	94.3777	(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	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.8696	83.9985	75.8696	78.3986	75.8696	78.3986	75.8696	75.8696	78.3986	75.8696	78.3986	75.8696
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	146.8184	148.3419	144.5027	136.3295	126.0123	116.3155	109.8375	108.3140	112.1532	120.3264	130.6436	140.3404

# Full SAP Calculation Printout



Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156 (71)
Water heating gains (Table 5)	127.7841	125.9455	122.5114	115.1303	110.5762	71.8561	69.0054	71.4596	74.3242	113.5637	120.6470	126.8518	126.8518 (72)
Total internal gains	398.7530	406.5668	391.1646	378.1392	360.7389	314.8511	302.9934	303.9241	313.1569	358.0406	377.9701	391.3427	391.3427 (73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
North	2.1000	10.6334	0.5700	0.7000	0.7700	6.1744 (74)						
South	3.5500	46.7521	0.5700	0.7000	0.7700	45.8918 (78)						
West	4.4100	19.6403	0.5700	0.7000	0.7700	23.9493 (80)						
Solar gains	76.0155	133.8085	192.9447	252.9383	294.0470	296.1285	283.7862	252.8140	213.8526	150.7032	91.8763	64.4968 (83)
Total gains	474.7685	540.3753	584.1093	631.0775	654.7859	610.9796	586.7796	556.7381	527.0095	508.7439	469.8464	455.8395 (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)	104.9488	105.0968	105.2452	105.9936	106.1445	106.9058	106.9058	107.0593	106.6000	106.1445	105.8430	105.5433
tau	7.9966	8.0065	8.0163	8.0662	8.0763	8.1271	8.1271	8.1373	8.1067	8.0763	8.0562	8.0362
util living area	0.9378	0.8722	0.7709	0.6106	0.4547	0.3333	0.2386	0.2625	0.4176	0.6476	0.8659	0.9497 (86)
Living	20.7880	20.8714	20.9280	20.9560	20.9609	20.9617	20.9617	20.9617	20.9614	20.9545	20.8894	20.7656
Non living	20.1457	20.2424	20.3046	20.3364	20.3416	20.3464	20.3464	20.3473	20.3445	20.3363	20.2681	20.1221
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	20.8916	20.8714	20.9280	20.9560	20.9609	20.9617	20.9617	20.9617	20.9614	20.9545	20.8894	20.7984 (87)
Th 2	20.3849	20.3857	20.3865	20.3906	20.3914	20.3955	20.3955	20.3963	20.3939	20.3914	20.3898	20.3882 (88)
util rest of house	0.9257	0.8528	0.7447	0.5811	0.4251	0.3018	0.2058	0.2281	0.3810	0.6120	0.8428	0.9395 (89)
MIT 2	20.2896	20.2424	20.3046	20.3364	20.3416	20.3464	20.3464	20.3473	20.3445	20.3363	20.2681	20.1701 (90)
Living area fraction	20.5717	20.5372	20.5968	20.6268	20.6319	20.6347	20.6348	20.6353	20.6336	20.6260	20.5593	20.4687 (91)
MIT	20.5717	20.5372	20.5968	20.6268	20.6319	20.6347	20.6348	20.6353	20.6336	20.6260	20.5593	20.4646 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5717	20.5372	20.5968	20.6268	20.6319	20.6347	20.6348	20.6353	20.6336	20.6260	20.5593	20.4646 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9296	0.8577	0.7538	0.5926	0.4369	0.3143	0.2188	0.2417	0.3955	0.6258	0.8494	0.9408 (94)
Useful gains	441.3553	463.5055	440.3213	373.9841	286.0466	192.0131	128.3848	134.5705	208.4265	318.3744	399.1100	428.8742 (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	527.4161	506.1349	455.6343	376.3547	286.2485	192.0240	128.3853	134.5715	208.4950	321.3136	432.5709	524.2145 (97)
Space heating kWh	64.0292	28.6470	11.3929	1.7068	0.1502	0.0000	0.0000	0.0000	0.0000	2.1868	24.0919	70.9332 (98a)
Space heating requirement - total per year (kWh/year)												203.1380
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	64.0292	28.6470	11.3929	1.7068	0.1502	0.0000	0.0000	0.0000	0.0000	2.1868	24.0919	70.9332 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												203.1380
Space heating per m2										(98c) / (4) =		4.0758 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												266.1970 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	64.0292	28.6470	11.3929	1.7068	0.1502	0.0000	0.0000	0.0000	0.0000	2.1868	24.0919	70.9332 (98)
Space heating efficiency (main heating system 1)	266.1970	266.1970	266.1970	266.1970	266.1970	0.0000	0.0000	0.0000	0.0000	266.1970	266.1970	266.1970 (210)

# Full SAP Calculation Printout



Space heating fuel (main heating system)	24.0533	10.7616	4.2799	0.6412	0.0564	0.0000	0.0000	0.0000	0.0000	0.8215	9.0504	26.6469 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (64)
Efficiency of water heater												171.5109 (216)
(217)m	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109 (217)
Fuel for water heating, kWh/month	147.9633	131.4777	141.0843	127.2142	125.5132	97.6439	97.1796	100.3814	100.7601	129.4109	134.1793	146.7470 (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	7.2878	6.5825	7.2878	7.0527	7.2878	7.0527	7.2878	7.2878	7.0527	7.2878	7.0527	7.2878 (231)
Lighting	15.0671	12.0874	10.8833	7.9736	6.1590	5.0320	5.6185	7.3031	9.4860	12.4462	14.0579	15.4858 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-28.5199	-51.2075	-94.0875	-128.9936	-156.4920	-148.5926	-145.9195	-129.6069	-100.7266	-66.7927	-34.4558	-23.1975 (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	-1.1925	-4.5309	-15.6198	-36.8944	-62.9226	-72.5914	-70.0667	-49.8102	-26.4542	-8.6310	-2.0395	-0.8010 (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												76.3111 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												171.5109
Water heating fuel used												1479.5549 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5880)												
mechanical ventilation fans (SFP = 0.5880)												85.8077 (230a)
Total electricity for the above, kWh/year												85.8077 (231)
Electricity for lighting (calculated in Appendix L)												121.5998 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1460.1462 (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												303.1274 (238)

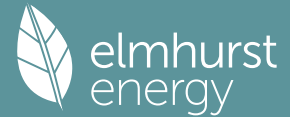
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	76.3111	0.1601	12.2183 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1479.5549	0.1415	209.3201 (264)
Space and water heating			221.5384 (265)
Pumps, fans and electric keep-hot	85.8077	0.1387	11.9026 (267)
Energy for lighting	121.5998	0.1443	17.5506 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1108.5922	0.1310	-145.2410
PV Unit electricity exported	-351.5540	0.1165	-40.9666
Total			-186.2076 (269)
Total CO2, kg/year			64.7840 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3000 (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	76.3111	1.5926	121.5300 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5549	1.5232	2253.6131 (278)
Space and water heating			2375.1431 (279)
Pumps, fans and electric keep-hot	85.8077	1.5128	129.8099 (281)
Energy for lighting	121.5998	1.5338	186.5138 (282)

# Full SAP Calculation Printout



Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1108.5922	1.4840	-1645.1585
PV Unit electricity exported	-351.5540	0.4271	-150.1652
Total			-1795.3237 (283)
Total Primary energy kWh/year			896.1432 (286)
Dwelling Primary energy Rate (DPER)			17.9800 (287)

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	49.8400 (1b)	2.4000 (2b)	119.6160 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400		119.6160 (5)
Dwelling volume			

### 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	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) = 0.1672 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4172 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3859 (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 infiltr rate	0.4920	0.4824	0.4727	0.4245	0.4149	0.3666	0.3666	0.3570	0.3859	0.4149	0.4342	0.4534 (22b)
Effective ac	0.6211	0.6163	0.6117	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5942	0.6028 (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			1.6800	1.0000	1.6800		(26a)
TER Opening Type (Uw = 1.20)			10.0600	1.1450	11.5191		(27)
Ground Floor			49.8400	0.1300	6.4792		(28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1800	9.4860		(29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 29.1643		(33)
Party Walls			10.6800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 255.7095 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900
E3 Sill	1.4000	0.0500	0.0700
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.1600	4.2960
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0700	1.8795
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	4.8000	0.0600	0.2880
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.1955 (36)
Point Thermal bridges			(36a) = 0.0000

# Full SAP Calculation Printout



Total fabric heat loss													(33) + (36) + (36a) =	37.3598 (37)
Ventilation heat loss calculated monthly (38) <sub>m</sub> = 0.33 x (25) <sub>m</sub> x (5)														
(38) <sub>m</sub>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)	
Heat transfer coeff	24.5149	24.3293	24.1475	23.2932	23.1334	22.3894	22.3894	22.2516	22.6760	23.1334	23.4567	23.7948	(39)	
Average = Sum(39) <sub>m</sub> / 12 =	61.8747	61.6891	61.5073	60.6530	60.4932	59.7492	59.7492	59.6114	60.0358	60.4932	60.8165	61.1545	60.6523	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)	
HLP (average)	1.2415	1.2377	1.2341	1.2170	1.2137	1.1988	1.1988	1.1961	1.2046	1.2137	1.2202	1.2270	(40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)	

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

Assumed occupancy													1.6854 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths													60.4497 (42b)
Hot water usage for other uses													31.8901 (42c)
Average daily hot water use (litres/day)													85.0374 (43)
Daily hot water use													92.3398 (44)
Energy content (annual)													146.2437 (45)
Distribution loss (46) <sub>m</sub> = 0.15 x (45) <sub>m</sub>													21.9366 (46)
Water storage loss:													150.0000 (47)
Store volume													1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7527 (55)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													23.3325 (56)
If cylinder contains dedicated solar storage													23.3325 (57)
Primary loss													23.2624 (59)
Combi loss													0.0000 (61)
Total heat required for water heating calculated for each month													192.8386 (62)
MWHRS													0.0000 (63a)
PV diverter													-0.0000 (63b)
Solar input													0.0000 (63c)
FGHRS													0.0000 (63d)
Output from w/h													192.8386 (64)
Total per year (kWh/year) = Sum(64) <sub>m</sub> =													1960.7867 (64)
Electric shower(s)													1961 (64)
Heat gains from water heating, kWh/month													85.9020 (65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) <sub>m</sub> =													0.0000 (64a)

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

Metabolic gains (Table 5), Watts													
(66) <sub>m</sub>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	74.5053	82.4880	74.5053	76.9888	74.5053	76.9888	74.5053	74.5053	76.9888	74.5053	76.9888	74.5053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	146.8184	148.3419	144.5027	136.3295	126.0123	116.3155	109.8375	108.3140	112.1532	120.3264	130.6436	140.3404	(69)
Pumps, fans	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	(70)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(71)
Water heating gains (Table 5)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	(72)
Total internal gains	115.4596	113.7129	110.4505	103.4385	99.1121	94.6027	91.8945	94.2260	96.9474	101.9502	108.6793	114.5739	(73)
	388.0641	395.8237	380.7393	368.0376	350.9105	336.1878	324.5182	325.3261	334.3702	348.0628	367.5926	380.7004	(73)

## 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d	

# Full SAP Calculation Printout



North			2.1000		10.6334		0.6300		0.7000		0.7700		6.8244 (74)
South			3.5500		46.7521		0.6300		0.7000		0.7700		50.7225 (78)
West			4.4100		19.6403		0.6300		0.7000		0.7700		26.4702 (80)

Solar gains	84.0171	147.8936	213.2547	279.5634	324.9993	327.2999	313.6584	279.4261	236.3634	166.5667	101.5475	71.2859	(83)
Total gains	472.0813	543.7173	593.9940	647.6010	675.9098	663.4877	638.1766	604.7522	570.7336	514.6295	469.1401	451.9863	(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	57.2149	57.3870	57.5567	58.3673	58.5216	59.2503	59.2503	59.3872	58.9675	58.5216	58.2104	57.8887	
alpha	4.8143	4.8258	4.8371	4.8912	4.9014	4.9500	4.9500	4.9591	4.9312	4.9014	4.8807	4.8592	
util living area	0.9874	0.9745	0.9484	0.8777	0.7465	0.5598	0.4089	0.4485	0.6776	0.9021	0.9741	0.9896	(86)
MIT	19.8210	20.0363	20.3163	20.6545	20.8788	20.9770	20.9960	20.9937	20.9425	20.6556	20.1897	19.7910	(87)
Th 2	19.8870	19.8899	19.8928	19.9065	19.9090	19.9209	19.9209	19.9232	19.9163	19.9090	19.9038	19.8984	(88)
util rest of house	0.9834	0.9667	0.9327	0.8426	0.6834	0.4725	0.3103	0.3461	0.5896	0.8657	0.9647	0.9862	(89)
MIT 2	18.5527	18.8247	19.1724	19.5799	19.8160	19.9091	19.9198	19.9212	19.8822	19.5937	19.0307	18.5232	(90)
Living area fraction									fLA = Living area / (4) =				0.4687 (91)
MIT	19.1472	19.3926	19.7085	20.0836	20.3142	20.4096	20.4242	20.4239	20.3792	20.0914	19.5739	19.1174	(92)
Temperature adjustment													0.0000
adjusted MIT	19.1472	19.3926	19.7085	20.0836	20.3142	20.4096	20.4242	20.4239	20.3792	20.0914	19.5739	19.1174	(93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9799	0.9624	0.9296	0.8489	0.7081	0.5129	0.3566	0.3942	0.6288	0.8726	0.9611	0.9831	(94)
Useful gains	462.5776	523.2600	552.1555	549.7465	478.5875	340.2741	227.5825	238.3886	358.8724	449.0579	450.9135	444.3459	(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	918.6642	894.0345	812.4196	678.3168	521.0977	347.1200	228.4930	239.8702	376.9740	574.1649	758.6205	912.2694	(97)
Space heating kWh	339.3284	249.1604	193.6365	92.5706	31.6276	0.0000	0.0000	0.0000	0.0000	93.0796	221.5491	348.1351	(98a)
Space heating requirement - total per year (kWh/year)												1569.0873	
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	339.3284	249.1604	193.6365	92.5706	31.6276	0.0000	0.0000	0.0000	0.0000	93.0796	221.5491	348.1351	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1569.0873	
Space heating per m2										(98c) / (4) =		31.4825	(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	339.3284	249.1604	193.6365	92.5706	31.6276	0.0000	0.0000	0.0000	0.0000	93.0796	221.5491	348.1351	(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)	367.6364	269.9463	209.7904	100.2932	34.2661	0.0000	0.0000	0.0000	0.0000	100.8446	240.0315	377.1778	(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	192.8386	170.6467	181.6302	160.5873	156.2595	141.4541	140.1095	145.3264	146.5314	162.6101	171.9359	190.8568	(64)
Efficiency of water heater (217)m	85.3134	84.9075	84.2036	82.8712	81.1851	79.8000	79.8000	79.8000	79.8000	82.8570	84.6294	79.8000	(216)
Fuel for water heating, kWh/month	226.0356	200.9796	215.7037	193.7792	192.4732	177.2608	175.5759	182.1133	183.6234	196.2539	203.1634	223.5122	(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	15.4807	12.4192	11.1821	8.1925	6.3281	5.1701	5.7727	7.5036	9.7464	12.7879	14.4439	15.9110	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-17.1649	-25.0934	-37.3996	-43.6742	-48.5367	-45.8647	-45.3349	-42.0996	-36.6115	-29.4403	-19.1968	-14.7398	(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)													

# Full SAP Calculation Printout



(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)
(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	-7.1603	-15.2944	-30.8212	-46.9022	-62.5957	-63.0745	-62.3010	-52.4599	-38.0918	-22.0391	-9.6166	-5.6428	(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												1699.9862	(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												2370.4740	(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)												124.9383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-821.1556	(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												3460.2429	(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	1699.9862	0.2100	356.9971 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2370.4740	0.2100	497.7995 (264)
Space and water heating			854.7966 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	124.9383	0.1443	18.0325 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-405.1563	0.1338	-54.2101
PV Unit electricity exported	-415.9993	0.1255	-52.2186
Total			-106.4287 (269)
Total CO2, kg/year			778.3297 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6200 (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	1699.9862	1.1300	1920.9844 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2370.4740	1.1300	2678.6356 (278)
Space and water heating			4599.6201 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	124.9383	1.5338	191.6345 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-405.1563	1.4945	-605.4895
PV Unit electricity exported	-415.9993	0.4607	-191.6714
Total			-797.1609 (283)
Total Primary energy kWh/year			4124.1944 (286)
Target Primary Energy Rate (TPER)			82.7500 (287)

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

## 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	49.8400 (1b)	x 2.4000 (2b)	= 119.6160 (1b) -



# Full SAP Calculation Printout



Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 49.8400 (4)  
 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (5)

## 2. Ventilation rate

m3 per hour

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1672 (8)  
 Pressure test Yes  
 Pressure Test Method Blower Door  
 Measured/design AP50 1.0000 (17)  
 Infiltration rate 0.2172 (18)  
 Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2009 (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	0.2562	0.2511	0.2461	0.2210	0.2160	0.1909	0.1909	0.1858	0.2009	0.2160	0.2260	0.2361 (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	0.5328	0.5315	0.5303	0.5244	0.5233	0.5182	0.5182	0.5173	0.5202	0.5233	0.5255	0.5279 (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
Windows/Doors (Uw = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000 (29a)
Total net area of external elements Aum(A, m2)			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1881		(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000 (32)
Party Ceiling			49.8400			30.0000	1495.2000 (32b)
Internal Walls			75.8400			9.0000	682.5600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12744.5600 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 255.7095 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3250 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 26.5130 (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	21.0317	20.9815	20.9322	20.7006	20.6573	20.4556	20.4556	20.4183	20.5333	20.6573	20.7449	20.8366 (38)
Heat transfer coeff	47.5448	47.4945	47.4452	47.2136	47.1703	46.9687	46.9687	46.9313	47.0463	47.1703	47.2580	47.3496 (39)
Average = Sum(39)m / 12 =												47.2134

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9539	0.9529	0.9519	0.9473	0.9464	0.9424	0.9424	0.9416	0.9439	0.9464	0.9482	0.9500 (40)
HLP (average)												0.9473
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy 1.6854 (42)  
 Hot water usage for mixer showers

# Full SAP Calculation Printout



Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for other uses	22.6905	22.3535	21.8789	21.0040	20.3488	19.6223	19.2299	19.7011	20.2142	20.9916	21.8846	22.6138	22.6138	(42b)
Average daily hot water use (litres/day)	31.8901	30.7305	29.5708	28.4112	27.2515	26.0919	26.0919	27.2515	28.4112	29.5708	30.7305	31.8901	50.0286	(42c)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content	54.5806	53.0839	51.4497	49.4151	47.6003	45.7142	45.3218	46.9527	48.6254	50.5624	52.6150	54.5038	54.5038	(44)
Energy content (annual)	86.4423	75.5908	79.0763	67.6468	64.0792	56.2109	54.8128	58.1372	59.9599	68.6127	74.9597	85.3399	85.3399	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	73.4759	64.2522	67.2149	57.4998	54.4673	47.7793	46.5909	49.4166	50.9660	58.3208	63.7158	72.5389	72.5389	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	73.4759	64.2522	67.2149	57.4998	54.4673	47.7793	46.5909	49.4166	50.9660	58.3208	63.7158	72.5389	72.5389	(64)
Total per year (kWh/year)													706	(64)
Electric shower(s)	42.0261	37.4456	40.8892	39.0200	39.7522	37.9198	39.1837	39.7522	39.0200	40.8892	40.1203	42.0261	42.0261	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													478.0444	(64a)
Heat gains from water heating, kWh/month	28.8755	25.4244	27.0260	24.1300	23.5549	21.4248	21.4437	22.2922	22.4965	24.8025	25.9590	28.6412	28.6412	(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	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.8696	83.9985	75.8696	78.3986	75.8696	78.3986	75.8696	75.8696	78.3986	75.8696	78.3986	75.8696	75.8696	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	146.8184	148.3419	144.5027	136.3295	126.0123	116.3155	109.8375	108.3140	112.1532	120.3264	130.6436	140.3404	140.3404	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	(71)
Water heating gains (Table 5)	38.8112	37.8340	36.3253	33.5138	31.6598	29.7566	28.8221	29.9626	31.2451	33.3367	36.0542	38.4963	38.4963	(72)
Total internal gains	309.7801	318.4553	304.9785	296.5228	281.8225	272.7516	262.8101	262.4271	270.0778	277.8136	293.3773	302.9872	302.9872	(73)

## 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.1000	10.6334	0.5700	0.7000	0.7700	6.1744 (74)
South	3.5500	46.7521	0.5700	0.7000	0.7700	45.8918 (78)
West	4.4100	19.6403	0.5700	0.7000	0.7700	23.9493 (80)

Solar gains	76.0155	133.8085	192.9447	252.9383	294.0470	296.1285	283.7862	252.8140	213.8526	150.7032	91.8763	64.4968	64.4968	(83)
Total gains	385.7956	452.2638	497.9232	549.4611	575.8695	568.8801	546.5963	515.2412	483.9304	428.5168	385.2536	367.4839	367.4839	(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	74.4594	74.5383	74.6157	74.9816	75.0505	75.3727	75.3727	75.4327	75.2483	75.0505	74.9113	74.7664	74.7664	
alpha	5.9640	5.9692	5.9744	5.9988	6.0034	6.0248	6.0248	6.0288	6.0166	6.0034	5.9941	5.9844	5.9844	
util living area	0.9930	0.9818	0.9553	0.8733	0.7202	0.5230	0.3774	0.4177	0.6495	0.9082	0.9827	0.9947	0.9947	(86)
MIT	20.1003	20.2978	20.5350	20.7995	20.9474	20.9933	20.9992	20.9985	20.9774	20.7777	20.3900	20.0580	20.0580	(87)
Th 2	20.1219	20.1227	20.1236	20.1275	20.1282	20.1316	20.1316	20.1323	20.1303	20.1282	20.1267	20.1252	20.1252	(88)
util rest of house	0.9908	0.9763	0.9423	0.8413	0.6654	0.4545	0.3033	0.3396	0.5763	0.8768	0.9766	0.9930	0.9930	(89)
MIT 2	19.3118	19.5064	19.7355	19.9788	20.0967	20.1289	20.1314	20.1319	20.1197	19.9666	19.6020	19.2726	19.2726	(90)

# Full SAP Calculation Printout



Living area fraction											fLA = Living area / (4) =	0.4687 (91)
MIT	19.6814	19.8774	20.1102	20.3634	20.4954	20.5340	20.5381	20.5381	20.5217	20.3468	19.9714	19.6407 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6814	19.8774	20.1102	20.3634	20.4954	20.5340	20.5381	20.5381	20.5217	20.3468	19.9714	19.6407 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9895	0.9745	0.9421	0.8506	0.6892	0.4865	0.3381	0.3763	0.6100	0.8855	0.9753	0.9918 (94)	
Useful gains	381.7277	440.7404	469.1023	467.3549	396.8704	276.7676	184.7907	193.8679	295.1960	379.4681	375.7207	364.4801 (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	731.3048	711.3415	645.7404	541.2310	414.8834	278.7121	184.9696	194.2056	302.1178	459.7584	608.2747	731.1096 (97)	
Space heating kWh	260.0853	181.8439	131.4188	53.1908	13.4016	0.0000	0.0000	0.0000	0.0000	59.7360	167.4389	272.7723 (98a)	
Space heating requirement - total per year (kWh/year)												1139.8876	
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	260.0853	181.8439	131.4188	53.1908	13.4016	0.0000	0.0000	0.0000	0.0000	59.7360	167.4389	272.7723 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1139.8876	
Space heating per m2												(98c) / (4) =	22.8709 (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	441.5055	347.5682	356.6781	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9634	0.9854	0.9782	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	425.3527	342.5099	348.9167	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	636.6299	612.1353	576.9514	0.0000	0.0000	0.0000	0.0000 (103)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	152.1196	200.6013	169.6578	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	38.0299	50.1503	42.4145	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling requirement												130.5947 (107)	
Energy for space heating												22.8709 (99)	
Energy for space cooling												2.6203 (108)	
Total												25.4912 (109)	
Fabric Energy Efficiency (DFEE)												25.5 (109)	

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

## 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	49.8400 (1b)	x 2.4000 (2b)	= 119.6160 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (5)
Dwelling volume			

## 2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

# Full SAP Calculation Printout



Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											Air changes per hour	20.0000 / (5) =	0.1672 (8)
Pressure test												Yes		
Pressure Test Method												Blower Door		
Measured/design AP50													5.0000 (17)	
Infiltration rate													0.4172 (18)	
Number of sides sheltered													1 (19)	
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.3859 (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	0.4920	0.4824	0.4727	0.4245	0.4149	0.3666	0.3666	0.3570	0.3859	0.4149	0.4342	0.4534	(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	0.6211	0.6163	0.6117	0.5901	0.5861	0.5672	0.5672	0.5637	0.5745	0.5861	0.5942	0.6028	(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			1.6800	1.0000	1.6800			(26a)
TER Opening Type (Uw = 1.20)			10.0600	1.1450	11.5191			(27)
Ground Floor			49.8400	0.1300	6.4792			(28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1800	9.4860			(29a)
Total net area of external elements Aum(A, m2)			114.2800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.1643		(33)
Party Walls			10.6800	0.0000	0.0000			(32)

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

255.7095 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	5.8000	0.0500	0.2900	
E3 Sill	1.4000	0.0500	0.0700	
E4 Jamb	18.8000	0.0500	0.9400	
E5 Ground floor (normal)	26.8500	0.1600	4.2960	
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0700	1.8795	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.1955 (36)
Point Thermal bridges				(36a) = 0.0000
Total fabric heat loss				(33) + (36) + (36a) = 37.3598 (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	24.5149	24.3293	24.1475	23.2932	23.1334	22.3894	22.3894	22.2516	22.6760	23.1334	23.4567	23.7948	(38)
Average = Sum(39)m / 12 =	61.8747	61.6891	61.5073	60.6530	60.4932	59.7492	59.7492	59.6114	60.0358	60.4932	60.8165	61.1545	(39)
													60.6523

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2415	1.2377	1.2341	1.2170	1.2137	1.1988	1.1988	1.1961	1.2046	1.2137	1.2202	1.2270	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy													1.6854 (42)
Hot water usage for mixer showers													0.0000 (42a)
Hot water usage for baths	22.6905	22.3535	21.8789	21.0040	20.3488	19.6223	19.2299	19.7011	20.2142	20.9916	21.8846	22.6138	(42b)
Hot water usage for other uses	31.8901	30.7305	29.5708	28.4112	27.2515	26.0919	26.0919	27.2515	28.4112	29.5708	30.7305	31.8901	(42c)
Average daily hot water use (litres/day)													50.0286 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	54.5806	53.0839	51.4497	49.4151	47.6003	45.7142	45.3218	46.9527	48.6254	50.5624	52.6150	54.5038	(44)
Energy content (annual)	86.4423	75.5908	79.0763	67.6468	64.0792	56.2109	54.8128	58.1372	59.9599	68.6127	74.9597	85.3399	(45)
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 830.8685
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													
WWHRS	73.4759	64.2522	67.2149	57.4998	54.4673	47.7793	46.5909	49.4166	50.9660	58.3208	63.7158	72.5389	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

# Full SAP Calculation Printout



PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	73.4759	64.2522	67.2149	57.4998	54.4673	47.7793	46.5909	49.4166	50.9660	58.3208	63.7158	72.5389	706.2383	(64)
													706	(64)
12Total per year (kWh/year)														
Electric shower(s)	42.0261	37.4456	40.8892	39.0200	39.7522	37.9198	39.1837	39.7522	39.0200	40.8892	40.1203	42.0261	478.0444	(64a)
														(64a)
Heat gains from water heating, kWh/month	28.8755	25.4244	27.0260	24.1300	23.5549	21.4248	21.4437	22.2922	22.4965	24.8025	25.9590	28.6412		(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	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	84.2696	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.5053	82.4880	74.5053	76.9888	74.5053	76.9888	74.5053	74.5053	76.9888	74.5053	76.9888	74.5053	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	146.8184	148.3419	144.5027	136.3295	126.0123	116.3155	109.8375	108.3140	112.1532	120.3264	130.6436	140.3404	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	31.4270	(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)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	(71)
Water heating gains (Table 5)	38.8112	37.8340	36.3253	33.5138	31.6598	29.7566	28.8221	29.9626	31.2451	33.3367	36.0542	38.4963	(72)
Total internal gains	308.4157	316.9447	303.6141	295.1129	280.4582	271.3418	261.4457	261.0627	268.6680	276.4492	291.9675	301.6228	(73)

## 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
North		2.1000	10.6334	0.6300	0.7000	0.7700	6.8244 (74)						
South		3.5500	46.7521	0.6300	0.7000	0.7700	50.7225 (78)						
West		4.4100	19.6403	0.6300	0.7000	0.7700	26.4702 (80)						
Solar gains	84.0171	147.8936	213.2547	279.5634	324.9993	327.2999	313.6584	279.4261	236.3634	166.5667	101.5475	71.2859	(83)
Total gains	392.4328	464.8383	516.8688	574.6763	605.4575	598.6416	575.1042	540.4888	505.0313	443.0159	393.5150	372.9087	(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, n <sub>l,m</sub> (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.2149	57.3870	57.5567	58.3673	58.5216	59.2503	59.2503	59.3872	58.9675	58.5216	58.2104	57.8887	
alpha	4.8143	4.8258	4.8371	4.8912	4.9014	4.9500	4.9500	4.9591	4.9312	4.9014	4.8807	4.8592	
util living area	0.9941	0.9862	0.9687	0.9141	0.7987	0.6118	0.4519	0.4985	0.7400	0.9393	0.9871	0.9954	(86)
MIT	19.6630	19.8877	20.1858	20.5645	20.8349	20.9662	20.9937	20.9900	20.9152	20.5551	20.0466	19.6325	(87)
Th 2	19.8870	19.8899	19.8928	19.9065	19.9090	19.9209	19.9209	19.9232	19.9163	19.9090	19.9038	19.8984	(88)
util rest of house	0.9921	0.9817	0.9582	0.8860	0.7392	0.5200	0.3439	0.3864	0.6525	0.9131	0.9820	0.9938	(89)
MIT 2	18.6915	18.9156	19.2091	19.5757	19.8066	19.9070	19.9195	19.9207	19.8752	19.5777	19.0854	18.6701	(90)
Living area fraction									f <sub>LA</sub> = Living area / (4) =			0.4687	(91)
MIT	19.1469	19.3712	19.6669	20.0391	20.2886	20.4034	20.4230	20.4219	20.3626	20.0358	19.5359	19.1212	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1469	19.3712	19.6669	20.0391	20.2886	20.4034	20.4230	20.4219	20.3626	20.0358	19.5359	19.1212	(93)

## 8. Space heating requirement

Utilisation	0.9904	0.9790	0.9556	0.8898	0.7614	0.5622	0.3947	0.4392	0.6907	0.9167	0.9798	0.9923	(94)
Useful gains	388.6610	455.0653	493.8950	511.3630	460.9952	336.5801	226.9907	237.3630	348.8452	406.1068	385.5626	370.0426	(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	918.6462	892.7175	809.8574	675.6228	519.5517	346.7510	228.4220	239.7502	375.9818	570.8012	756.3105	912.4961	(97)
Space heating kWh	394.3090	294.1023	235.0761	118.2670	43.5660	0.0000	0.0000	0.0000	0.0000	122.5327	266.9385	403.5854	(98a)
Space heating requirement - total per year (kWh/year)												1878.3770	
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													

# Full SAP Calculation Printout



394.3090 294.1023 235.0761 118.2670 43.5660 0.0000 0.0000 0.0000 0.0000 122.5327 266.9385 403.5854 (98c)  
 Space heating requirement after solar contribution - total per year (kWh/year) 1878.3770  
 Space heating per m2 (98c) / (4) = 37.6881 (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	561.6422	442.1439	453.0466	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8974	0.9463	0.9283	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	504.0381	418.4056	420.5574	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	672.9446	646.9219	607.8887	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	121.6127	170.0161	139.3745	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	30.4032	42.5040	34.8436	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												107.7508 (107)
Energy for space heating												37.6881 (99)
Energy for space cooling												2.1619 (108)
Total												39.8501 (109)
Fabric Energy Efficiency (TFEE)												39.9 (109)

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

### 1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	49.8400 (1b)	2.4000 (2b)	119.6160 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400		119.6160 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (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)

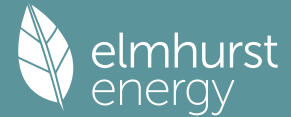
Pressure test  
 Pressure Test Method  
 Measured/design AP50  
 Infiltration rate  
 Number of sides sheltered

Air changes per hour  
 Yes  
 Blower Door  
 1.0000 (17)  
 0.0500 (18)  
 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.0463 (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												
	0.0590	0.0578	0.0567	0.0509	0.0497	0.0439	0.0439	0.0428	0.0463	0.0497	0.0520	0.0543 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)
Effective ac	0.1495	0.1483	0.1472	0.1414	0.1402	0.1344	0.1344	0.1333	0.1367	0.1402	0.1425	0.1448 (25)

# Full SAP Calculation Printout



### 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
Windows/Doors (Uw = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000 (29a)
Total net area of external elements Aum(A, m2)			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1881		(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000 (32)
Party Ceiling			49.8400			30.0000	1495.2000 (32b)
Internal Walls			75.8400			9.0000	682.5600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12744.5600 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 255.7095 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.3250 (36)

Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 26.5130 (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	5.9000	5.8544	5.8087	5.5805	5.5349	5.3067	5.3067	5.2610	5.3980	5.5349	5.6262	5.7175 (38)
Average = Sum(39)m / 12 =	32.4130	32.3674	32.3218	32.0936	32.0479	31.8197	31.8197	31.7741	31.9110	32.0479	32.1392	32.2305 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6503	0.6494	0.6485	0.6439	0.6430	0.6384	0.6384	0.6375	0.6403	0.6430	0.6448	0.6467 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy													1.6854 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	63.6313	62.6863	61.3555	58.9018	57.0645	55.0272	53.9268	55.2482	56.6871	58.8670	61.3713	63.4162 (42b)	
Hot water usage for other uses	33.5685	32.3478	31.1272	29.9065	28.6858	27.4652	27.4652	28.6858	29.9065	31.1272	32.3478	33.5685 (42c)	
Average daily hot water use (litres/day)													89.5131 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.1998	95.0341	92.4827	88.8083	85.7503	82.4924	81.3919	83.9341	86.5936	89.9942	93.7191	96.9847 (44)
Energy content (annual)	153.9408	135.3274	142.1425	121.5741	115.4364	101.4340	98.4365	103.9279	106.7785	122.1213	133.5201	151.8546 (45)
Distribution loss (46)m = 0.15 x (45)m	23.0911	20.2991	21.3214	18.2361	17.3155	15.2151	14.7655	15.5892	16.0168	18.3182	20.0280	22.7782 (46)

Water storage loss:  
 Store volume 150.0000 (47)  
 a) If manufacturer declared loss factor is known (kWh/day):  
 Temperature factor from Table 2b 0.7800 (48)  
 Enter (49) or (54) in (55) 1.4508 (55)

Total storage loss	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (56)
If cylinder contains dedicated solar storage	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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)

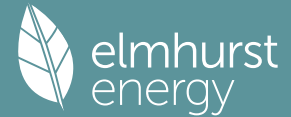
Total heat required for water heating calculated for each month	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-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 253.7732 225.4986 241.9749 218.1861 215.2688 167.4700 166.6737 172.1651 172.8145 221.9537 230.1321 251.6870 (64)  
 Total per year (kWh/year) = Sum(64)m = 2537.5975 (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	95.0714	84.6354	91.1484	82.8938	82.2687	51.7364	51.3400	53.1659	53.5135	84.4914	86.8658	94.3777 (65)
--	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--------------

# Full SAP Calculation Printout



## 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	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.2137	15.2891	12.4339	9.4133	7.0365	5.9405	6.4190	8.3436	11.1988	14.2194	16.5961	17.6921 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.1319	221.4058	215.6757	203.4768	188.0780	173.6052	163.9366	161.6627	167.3928	179.5917	194.9905	209.4633 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977 (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)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156 (71)
Water heating gains (Table 5)	127.7841	125.9455	122.5114	115.1303	110.5762	71.8561	69.0054	71.4596	74.3242	113.5637	120.6470	126.8518 (72)
Total internal gains	444.6353	443.1460	431.1265	408.5259	386.1963	331.9074	319.8665	321.9714	333.4214	387.8803	412.7392	434.5127 (73)

## 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	2.1000	10.6334	0.5700	0.7000	0.7700	6.1744 (74)						
South	3.5500	46.7521	0.5700	0.7000	0.7700	45.8918 (78)						
West	4.4100	19.6403	0.5700	0.7000	0.7700	23.9493 (80)						
Solar gains	76.0155	133.8085	192.9447	252.9383	294.0470	296.1285	283.7862	252.8140	213.8526	150.7032	91.8763	64.4968 (83)
Total gains	520.6508	576.9544	624.0712	661.4642	680.2433	628.0359	603.6527	574.7855	547.2740	538.5836	504.6155	499.0095 (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, n <sub>l,m</sub> (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	109.2201	109.3741	109.5285	110.3073	110.4644	111.2567	111.2567	111.4165	110.9384	110.4644	110.1507	109.8387
alpha	8.2813	8.2916	8.3019	8.3538	8.3643	8.4171	8.4171	8.4278	8.3959	8.3643	8.3434	8.3226
util living area	0.9088	0.8418	0.7323	0.5842	0.4379	0.3242	0.2319	0.2543	0.4022	0.6145	0.8312	0.9254 (86)
Living	20.8438	20.9007	20.9422	20.9594	20.9625	20.9630	20.9630	20.9630	20.9628	20.9587	20.9152	20.8238
Non living	20.2105	20.2748	20.3193	20.3400	20.3435	20.3480	20.3481	20.3489	20.3462	20.3405	20.2957	20.1907
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	20.9201	20.9007	20.9422	20.9594	20.9625	20.9630	20.9630	20.9630	20.9628	20.9587	20.9152	20.8485 (87)
Th 2	20.3849	20.3857	20.3865	20.3906	20.3914	20.3955	20.3955	20.3963	20.3939	20.3914	20.3898	20.3882 (88)
util rest of house	0.8929	0.8201	0.7055	0.5556	0.4093	0.2936	0.2001	0.2209	0.3669	0.5800	0.8055	0.9115 (89)
MIT 2	20.3154	20.2748	20.3193	20.3400	20.3435	20.3480	20.3481	20.3489	20.3462	20.3405	20.2957	20.2263 (90)
Living area fraction	f <sub>LA</sub> = Living area / (4) =											0.4687 (91)
MIT	20.5988	20.5682	20.6113	20.6303	20.6336	20.6363	20.6363	20.6368	20.6352	20.6302	20.5860	20.5179 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5988	20.5682	20.6113	20.6303	20.6336	20.6363	20.6363	20.6368	20.6352	20.6302	20.5860	20.5179 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8986	0.8267	0.7154	0.5669	0.4207	0.3058	0.2128	0.2342	0.3810	0.5936	0.8140	0.9146 (94)	
Useful gains	467.8792	476.9789	446.4906	374.9977	286.1839	192.0660	128.4330	134.6188	208.5062	319.7053	410.7633	456.4186 (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	528.2943	507.1384	456.1006	376.4682	286.3030	192.0723	128.4332	134.6193	208.5453	321.4482	433.4305	525.9340 (97)	
Space heating kWh	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195 (98a)	
Space heating requirement - total per year (kWh/year)												142.8499	
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	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												142.8499	
Space heating per m <sup>2</sup>												(98c) / (4) =	2.8662 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
---	--------------



# Full SAP Calculation Printout



Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													266.1970 (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	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195	(98)
Space heating efficiency (main heating system 1)	266.1970	266.1970	266.1970	266.1970	266.1970	0.0000	0.0000	0.0000	0.0000	266.1970	266.1970	266.1970	(210)
Space heating fuel (main heating system)	16.8856	7.6136	2.6859	0.3977	0.0333	0.0000	0.0000	0.0000	0.0000	0.4871	6.1309	19.4290	(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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	(64)
Efficiency of water heater	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	(216)
Fuel for water heating, kWh/month	147.9633	131.4777	141.0843	127.2142	125.5132	97.6439	97.1796	100.3814	100.7601	129.4109	134.1793	146.7470	(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	7.2878	6.5825	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	(231)
Lighting	15.0671	12.0874	10.8833	7.9736	6.1590	5.0320	5.6185	7.3031	9.4860	12.4462	14.0579	15.4858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.4983	-51.1673	-94.0232	-128.9691	-156.4880	-148.5926	-145.9195	-129.6069	-100.7266	-66.7842	-34.4386	-23.1826	(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	-1.2141	-4.5711	-15.6841	-36.9189	-62.9265	-72.5914	-70.0667	-49.8102	-26.4542	-8.6396	-2.0567	-0.8159	(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													53.6632 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.5109
Water heating fuel used													1479.5549 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5880)													
mechanical ventilation fans (SFP = 0.5880)													85.8077 (230a)
Total electricity for the above, kWh/year													85.8077 (231)
Electricity for lighting (calculated in Appendix L)													121.5998 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1460.1462 (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													280.4795 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	53.6632	16.4900	8.8491 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5549	16.4900	243.9786 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	85.8077	16.4900	14.1497 (249)
Energy for lighting	121.5998	16.4900	20.0518 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1108.3970	16.4900	-182.7747
PV Unit electricity exported	-351.7491	5.5900	-19.6628
Total			-202.4374 (252)
Total energy cost			84.5917 (255)

# Full SAP Calculation Printout



## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3211 (257)
SAP value		94.7950
SAP rating (Section 12)		95 (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	53.6632	0.1603	8.6017 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1479.5549	0.1415	209.3201 (264)
Space and water heating			217.9218 (265)
Pumps, fans and electric keep-hot	85.8077	0.1387	11.9026 (267)
Energy for lighting	121.5998	0.1443	17.5506 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1108.3970	0.1310	-145.2110
PV Unit electricity exported	-351.7491	0.1166	-41.0010
Total			-186.2120 (269)
Total CO2, kg/year			61.1630 (272)
CO2 emissions per m2			1.2300 (273)
EI value			99.1358
EI rating			99 (274)
EI band			A

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

### 1. Overall dwelling characteristics

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	49.8400 (1b)	2.4000 (2b)	119.6160 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (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		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0463 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.1000	4.3000	3.9000	3.7000	3.4000	3.5000	3.2000	3.6000	3.9000	3.5000	3.9000 (22)
Wind factor	1.0500	1.0250	1.0750	0.9750	0.9250	0.8500	0.8750	0.8000	0.9000	0.9750	0.8750	0.9750 (22a)
Adj infilt rate	0.0486	0.0474	0.0497	0.0451	0.0428	0.0393	0.0405	0.0370	0.0416	0.0451	0.0405	0.0451 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.9000 (23c)

# Full SAP Calculation Printout



Effective ac 0.1391 0.1379 0.1402 0.1356 0.1333 0.1298 0.1310 0.1275 0.1321 0.1356 0.1310 0.1356 (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
Windows/Doors (Uw = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000 (29a)
Total net area of external elements Aum(A, m2)			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1881		(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000 (32)
Party Ceiling			49.8400			30.0000	1495.2000 (32b)
Internal Walls			75.8400			9.0000	682.5600 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12744.5600 (34)  
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 255.7095 (35)

#### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976

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

Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 26.5130 (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	5.4893	5.4436	5.5349	5.3523	5.2610	5.1241	5.1698	5.0328	5.2154	5.3523	5.1698	5.3523 (38)
Average = Sum(39)m / 12 =	32.0023	31.9566	32.0479	31.8654	31.7741	31.6372	31.6828	31.5459	31.7284	31.8654	31.6828	31.8654 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6421	0.6412	0.6430	0.6394	0.6375	0.6348	0.6357	0.6329	0.6366	0.6394	0.6357	0.6394 (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												1.6854 (42)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for other uses	63.6313	62.6863	61.3555	58.9018	57.0645	55.0272	53.9268	55.2482	56.6871	58.8670	61.3713	63.4162 (42b)
Average daily hot water use (litres/day)	33.5685	32.3478	31.1272	29.9065	28.6858	27.4652	27.4652	28.6858	29.9065	31.1272	32.3478	33.5685 (42c)
Daily hot water use	97.1998	95.0341	92.4827	88.8083	85.7503	82.4924	81.3919	83.9341	86.5936	89.9942	93.7191	96.9847 (44)
Energy content (annual)	153.9408	135.3274	142.1425	121.5741	115.4364	101.4340	98.4365	103.9279	106.7785	122.1213	133.5201	151.8546 (45)
Distribution loss (46)m = 0.15 x (45)m	23.0911	20.2991	21.3214	18.2361	17.3155	15.2151	14.7655	15.5892	16.0168	18.3182	20.0280	22.7782 (46)
Water storage loss:												150.0000 (47)
Store volume												1.8600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.4508 (55)
Enter (49) or (54) in (55)												
Total storage loss	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (56)
If cylinder contains dedicated solar storage	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (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	95.0714	84.6354	91.1484	82.8938	82.2687	51.7364	51.3400	53.1659	53.5135	84.4914	86.8658	94.3777 (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	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.2137	15.2891	12.4339	9.4133	7.0365	5.9405	6.4190	8.3436	11.1988	14.2194	16.5961	17.6921 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.1319	221.4058	215.6757	203.4768	188.0780	173.6052	163.9366	161.6627	167.3928	179.5917	194.9905	209.4633 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977 (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)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156 (71)
Water heating gains (Table 5)	127.7841	125.9455	122.5114	115.1303	110.5762	71.8561	69.0054	71.4596	74.3242	113.5637	120.6470	126.8518 (72)
Total internal gains	444.6353	443.1460	431.1265	408.5259	386.1963	331.9074	319.8665	321.9714	333.4214	387.8803	412.7392	434.5127 (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	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North	2.1000	11.9957	0.5700	0.5700	0.7000	0.7700	6.9655 (74)					
South	3.5500	51.1372	0.5700	0.5700	0.7000	0.7700	50.1962 (75)					
West	4.4100	22.3485	0.5700	0.5700	0.7000	0.7700	27.2517 (80)					
Solar gains	84.4134	136.2008	192.9515	260.6001	295.6893	318.9379	300.7813	271.7553	229.7688	161.0126	101.8606	70.9218 (83)
Total gains	529.0487	579.3468	624.0780	669.1260	681.8855	650.8453	620.6478	593.7267	563.1902	548.8929	514.5998	505.4346 (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)												21.0000 (85)
tau	110.6220	110.7800	110.4644	111.0973	111.4165	111.8987	111.7375	112.2225	111.5768	111.0973	111.7375	111.0973
alpha	8.3748	8.3853	8.3643	8.4065	8.4278	8.4599	8.4492	8.4815	8.4385	8.4065	8.4492	8.4065
util living area	0.8897	0.8264	0.7055	0.5461	0.3960	0.2673	0.1787	0.1913	0.3549	0.5724	0.7955	0.9080 (86)
Living	20.8685	20.9117	20.9482	20.9611	20.9629	20.9632	20.9631	20.9633	20.9631	20.9607	20.9312	20.8519
Non living	20.2457	20.2939	20.3302	20.3457	20.3489	20.3516	20.3507	20.3533	20.3498	20.3455	20.3204	20.2296
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	20.9327	20.9117	20.9482	20.9611	20.9629	20.9632	20.9631	20.9633	20.9631	20.9607	20.9312	20.8726 (87)
Th 2	20.3923	20.3931	20.3914	20.3947	20.3963	20.3988	20.3980	20.4004	20.3972	20.3947	20.3980	20.3947 (88)
util rest of house	0.8718	0.8038	0.6780	0.5178	0.3679	0.2381	0.1479	0.1594	0.3209	0.5382	0.7678	0.8918 (89)
MIT 2	20.3338	20.2939	20.3302	20.3457	20.3489	20.3516	20.3507	20.3533	20.3498	20.3455	20.3204	20.2593 (90)
Living area fraction										flA = Living area / (4) =		0.4687 (91)
MIT	20.6145	20.5835	20.6198	20.6341	20.6367	20.6382	20.6377	20.6392	20.6372	20.6338	20.6067	20.5468 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6145	20.5835	20.6198	20.6341	20.6367	20.6382	20.6377	20.6392	20.6372	20.6338	20.6067	20.5468 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8786	0.8111	0.6885	0.5290	0.3791	0.2498	0.1602	0.1721	0.3345	0.5518	0.7777	0.8961 (94)
Useful gains	464.8192	469.8977	429.6520	353.9863	258.4899	162.5580	99.4125	102.1837	188.3668	302.8561	400.1800	452.9041 (95)
Ext temp.	4.6000	5.1000	7.0000	9.5000	12.5000	15.5000	17.5000	17.4000	14.7000	11.1000	7.5000	4.6000 (96)
Heat loss rate W	512.5018	494.7994	436.4878	354.7930	258.5352	162.5590	99.4125	102.1837	188.3790	303.7990	415.2555	508.1500 (97)
Space heating kWh	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029 (98a)
Space heating requirement - total per year (kWh/year)												110.5689
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	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												110.5689
Space heating per m <sup>2</sup>										(98c) / (4) =		2.2185 (99)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													265.2579 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029	(98)
Space heating efficiency (main heating system 1)	265.2579	265.2579	265.2579	265.2579	265.2579	0.0000	0.0000	0.0000	0.0000	265.2579	265.2579	265.2579	(210)
Space heating fuel (main heating system)	13.3741	6.3085	1.9173	0.2190	0.0127	0.0000	0.0000	0.0000	0.0000	0.2645	4.0920	15.4955	(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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	(64)
Efficiency of water heater	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	(216)
Fuel for water heating, kWh/month	147.9581	131.4731	141.0793	127.2097	125.5088	97.6405	97.1762	100.3779	100.7566	129.4063	134.1746	146.7418	(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	7.2878	6.5825	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	7.2878	7.0527	(231)
Lighting	15.0671	12.0874	10.8833	7.9736	6.1590	5.0320	5.6185	7.3031	9.4860	12.4462	14.0579	15.4858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-32.6706	-53.7497	-96.4884	-134.1189	-158.6861	-156.5957	-152.4965	-137.8954	-108.7178	-72.9686	-39.3143	-26.3608	(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)	-1.6130	-5.0852	-16.6473	-40.6165	-65.2995	-84.4949	-79.4886	-58.6635	-31.7340	-10.4546	-2.7107	-1.0660	(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													41.6835 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.5169
Water heating fuel used													1479.5028 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5880) mechanical ventilation fans (SFP = 0.5880)													85.8077 (230a)
Total electricity for the above, kWh/year													85.8077 (231)
Electricity for lighting (calculated in Appendix L)													121.5998 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1567.9365 (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													160.6574 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	41.6835	21.5100	8.9661 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5028	21.5100	318.2411 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	85.8077	21.5100	18.4572 (249)
Energy for lighting	121.5998	21.5100	26.1561 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	21.5100	-251.6805
PV Unit electricity exported	-397.8738	5.5900	-22.2411
Total			-273.9216 (252)
Total energy cost			97.8989 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	41.6835	0.1606	6.6953 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1479.5028	0.1415	209.3127 (264)
Space and water heating			216.0080 (265)
Pumps, fans and electric keep-hot	85.8077	0.1387	11.9026 (267)
Energy for lighting	121.5998	0.1443	17.5506 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	0.1311	-153.3970
PV Unit electricity exported	-397.8738	0.1160	-46.1603
Total			-199.5573 (269)
Total CO2, kg/year			45.9040 (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	41.6835	1.5945	66.4629 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5028	1.5232	2253.5338 (278)
Space and water heating			2319.9967 (279)
Pumps, fans and electric keep-hot	85.8077	1.5128	129.8099 (281)
Energy for lighting	121.5998	1.5338	186.5138 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	1.4843	-1736.7554
PV Unit electricity exported	-397.8738	0.4252	-169.1582
Total			-1905.9136 (283)
Total Primary energy kWh/year			730.4069 (286)

-----  
 SAP 10 EPC IMPROVEMENTS  
 -----

P23972(1)

Current energy efficiency rating: A 95  
 Current environmental impact rating: A 99

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

Recommended measures: SAP change Cost change CO2 change  
 (none)

Recommended measures Typical annual savings Energy Environmental  
 (none) Total Savings £0 0.00 kg/m<sup>2</sup> efficiency impact

Potential energy efficiency rating: A 95  
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 528 TEST (04 Oct 2023)  
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£372	£372	£0
Space heating	£27	£27	£0
Water heating	£318	£318	£0
Lighting	£26	£26	£0
Generated (PV)	-£274	-£274	£0
Total cost of fuels	£98	£98	£0
Total cost of uses	£97	£97	£0
Delivered energy	3 kWh/m <sup>2</sup>	3 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.0 tonnes	0.0 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	1 kg/m <sup>2</sup>	1 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	15 kWh/m <sup>2</sup>	15 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

# Full SAP Calculation Printout



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> )	x	Storey height (m)	=	Volume (m <sup>3</sup> )
Ground floor	49.8400 (1b)		2.4000 (2b)		119.6160 (1b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400				(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (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) =	Air changes per hour 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		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0463 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.0590	0.0578	0.0567	0.0509	0.0497	0.0439	0.0439	0.0428	0.0463	0.0497	0.0520	0.0543 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.9000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1495	0.1483	0.1472	0.1414	0.1402	0.1344	0.1344	0.1333	0.1367	0.1402	0.1425	0.1448 (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
Windows/Doors (Uw = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.1881		(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000 (32)
Party Ceiling			49.8400			30.0000	1495.2000 (32b)
Internal Walls			75.8400			9.0000	682.5600 (32c)

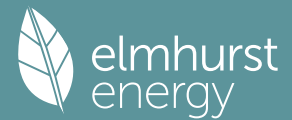
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12744.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K		255.7095 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.3250 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 26.5130 (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
---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

# Full SAP Calculation Printout



(38)m	5.9000	5.8544	5.8087	5.5805	5.5349	5.3067	5.3067	5.2610	5.3980	5.5349	5.6262	5.7175 (38)
Heat transfer coeff	32.4130	32.3674	32.3218	32.0936	32.0479	31.8197	31.8197	31.7741	31.9110	32.0479	32.1392	32.2305 (39)
Average = Sum(39)m / 12 =												32.0822
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6503	0.6494	0.6485	0.6439	0.6430	0.6384	0.6384	0.6375	0.6403	0.6430	0.6448	0.6467 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy												1.6854 (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	63.6313	62.6863	61.3555	58.9018	57.0645	55.0272	53.9268	55.2482	56.6871	58.8670	61.3713	63.4162 (42b)
Hot water usage for other uses	33.5685	32.3478	31.1272	29.9065	28.6858	27.4652	27.4652	28.6858	29.9065	31.1272	32.3478	33.5685 (42c)
Average daily hot water use (litres/day)												89.5131 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.1998	95.0341	92.4827	88.8083	85.7503	82.4924	81.3919	83.9341	86.5936	89.9942	93.7191	96.9847 (44)
Energy content (annual)	153.9408	135.3274	142.1425	121.5741	115.4364	101.4340	98.4365	103.9279	106.7785	122.1213	133.5201	151.8546 (45)
Distribution loss (46)m = 0.15 x (45)m	23.0911	20.2991	21.3214	18.2361	17.3155	15.2151	14.7655	15.5892	16.0168	18.3182	20.0280	22.7782 (46)
Water storage loss:												150.0000 (47)
Store volume												1.8600 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.7800 (49)
Temperature factor from Table 2b												1.4508 (55)
Enter (49) or (54) in (55)												
Total storage loss	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (56)
If cylinder contains dedicated solar storage	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748 (57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (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	95.0714	84.6354	91.1484	82.8938	82.2687	51.7364	51.3400	53.1659	53.5135	84.4914	86.8658	94.3777 (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	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.2137	15.2891	12.4339	9.4133	7.0365	5.9405	6.4190	8.3436	11.1988	14.2194	16.5961	17.6921 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.1319	221.4058	215.6757	203.4768	188.0780	173.6052	163.9366	161.6627	167.3928	179.5917	194.9905	209.4633 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977 (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)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156 (71)
Water heating gains (Table 5)	127.7841	125.9455	122.5114	115.1303	110.5762	71.8561	69.0054	71.4596	74.3242	113.5637	120.6470	126.8518 (72)
Total internal gains	444.6353	443.1460	431.1265	408.5259	386.1963	331.9074	319.8665	321.9714	333.4214	387.8803	412.7392	434.5127 (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	
North	2.1000	10.6334	0.5700	0.7000	0.7700	6.1744 (74)
South	3.5500	46.7521	0.5700	0.7000	0.7700	45.8918 (78)
West	4.4100	19.6403	0.5700	0.7000	0.7700	23.9493 (80)



# Full SAP Calculation Printout



Solar gains	76.0155	133.8085	192.9447	252.9383	294.0470	296.1285	283.7862	252.8140	213.8526	150.7032	91.8763	64.4968 (83)
Total gains	520.6508	576.9544	624.0712	661.4642	680.2433	628.0359	603.6527	574.7855	547.2740	538.5836	504.6155	499.0095 (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, n<sub>l,m</sub> (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	109.2201	109.3741	109.5285	110.3073	110.4644	111.2567	111.2567	111.4165	110.9384	110.4644	110.1507	109.8387
alpha	8.2813	8.2916	8.3019	8.3538	8.3643	8.4171	8.4171	8.4278	8.3959	8.3643	8.3434	8.3226
util living area	0.9088	0.8418	0.7323	0.5842	0.4379	0.3242	0.2319	0.2543	0.4022	0.6145	0.8312	0.9254 (86)
Living	20.8438	20.9007	20.9422	20.9594	20.9625	20.9630	20.9630	20.9630	20.9628	20.9587	20.9152	20.8238
Non living	20.2105	20.2748	20.3193	20.3400	20.3435	20.3480	20.3481	20.3489	20.3462	20.3405	20.2957	20.1907
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	20.9201	20.9007	20.9422	20.9594	20.9625	20.9630	20.9630	20.9630	20.9628	20.9587	20.9152	20.8485 (87)
Th 2	20.3849	20.3857	20.3865	20.3906	20.3914	20.3955	20.3955	20.3963	20.3939	20.3914	20.3898	20.3882 (88)
util rest of house	0.8929	0.8201	0.7055	0.5556	0.4093	0.2936	0.2001	0.2209	0.3669	0.5800	0.8055	0.9115 (89)
MIT 2	20.3154	20.2748	20.3193	20.3400	20.3435	20.3480	20.3481	20.3489	20.3462	20.3405	20.2957	20.2263 (90)
Living area fraction									f <sub>LA</sub> = Living area / (4) =			
MIT	20.5988	20.5682	20.6113	20.6303	20.6336	20.6363	20.6363	20.6368	20.6352	20.6302	20.5860	20.5179 (92)
Temperature adjustment												0.0000
adjusted MIT	20.5988	20.5682	20.6113	20.6303	20.6336	20.6363	20.6363	20.6368	20.6352	20.6302	20.5860	20.5179 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8986	0.8267	0.7154	0.5669	0.4207	0.3058	0.2128	0.2342	0.3810	0.5936	0.8140	0.9146 (94)
Useful gains	467.8792	476.9789	446.4906	374.9977	286.1839	192.0660	128.4330	134.6188	208.5062	319.7053	410.7633	456.4186 (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	528.2943	507.1384	456.1006	376.4682	286.3030	192.0723	128.4332	134.6193	208.5453	321.4482	433.4305	525.9340 (97)
Space heating kWh	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195 (98a)
Space heating requirement - total per year (kWh/year)												142.8499
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	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												142.8499
Space heating per m <sup>2</sup>										(98c) / (4) =		2.8662 (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 %) 266.1970 (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	44.9489	20.2672	7.1498	1.0588	0.0886	0.0000	0.0000	0.0000	0.0000	1.2967	16.3203	51.7195 (98)
Space heating efficiency (main heating system 1)	266.1970	266.1970	266.1970	266.1970	266.1970	0.0000	0.0000	0.0000	0.0000	266.1970	266.1970	266.1970 (210)
Space heating fuel (main heating system)	16.8856	7.6136	2.6859	0.3977	0.0333	0.0000	0.0000	0.0000	0.0000	0.4871	6.1309	19.4290 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (64)
Efficiency of water heater (217)m	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109	171.5109 (216)
Fuel for water heating, kWh/month	147.9633	131.4777	141.0843	127.2142	125.5132	97.6439	97.1796	100.3814	100.7601	129.4109	134.1793	146.7470 (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	7.2878	6.5825	7.2878	7.0527	7.2878	7.0527	7.2878	7.2878	7.0527	7.2878	7.0527	7.2878 (231)
Lighting	15.0671	12.0874	10.8833	7.9736	6.1590	5.0320	5.6185	7.3031	9.4860	12.4462	14.0579	15.4858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-28.4983	-51.1673	-94.0232	-128.9691	-156.4880	-148.5926	-145.9195	-129.6069	-100.7266	-66.7842	-34.4386	-23.1826 (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)												

# Full SAP Calculation Printout



(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)
(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	-1.2141	-4.5711	-15.6841	-36.9189	-62.9265	-72.5914	-70.0667	-49.8102	-26.4542	-8.6396	-2.0567	-0.8159	(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													53.6632 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.5109
Water heating fuel used													1479.5549 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5880)													
mechanical ventilation fans (SFP = 0.5880)													85.8077 (230a)
Total electricity for the above, kWh/year													85.8077 (231)
Electricity for lighting (calculated in Appendix L)													121.5998 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1460.1462 (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													280.4795 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	53.6632	16.4900	8.8491	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1479.5549	16.4900	243.9786	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	85.8077	16.4900	14.1497	(249)
Energy for lighting	121.5998	16.4900	20.0518	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1108.3970	16.4900	-182.7747	
PV Unit electricity exported	-351.7491	5.5900	-19.6628	
Total			-202.4374	(252)
Total energy cost			84.5917	(255)

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3211	(257)
SAP value		94.7950	
SAP rating (Section 12)		95	(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	53.6632	0.1603	8.6017	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1479.5549	0.1415	209.3201	(264)
Space and water heating			217.9218	(265)
Pumps, fans and electric keep-hot	85.8077	0.1387	11.9026	(267)
Energy for lighting	121.5998	0.1443	17.5506	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1108.3970	0.1310	-145.2110	
PV Unit electricity exported	-351.7491	0.1166	-41.0010	
Total			-186.2120	(269)
Total CO2, kg/year			61.1630	(272)
CO2 emissions per m2			1.2300	(273)
EI value			99.1358	
EI rating			99	(274)
EI band			A	

# Full SAP Calculation Printout



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

## 1. Overall dwelling characteristics

		Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor		49.8400 (1b)	x 2.4000 (2b)	= 119.6160 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	49.8400			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 119.6160 (5)
Dwelling volume				

## 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		1 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.0463 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.1000	4.3000	3.9000	3.7000	3.4000	3.5000	3.2000	3.6000	3.9000	3.5000	3.9000 (22)
Wind factor	1.0500	1.0250	1.0750	0.9750	0.9250	0.8500	0.8750	0.8000	0.9000	0.9750	0.8750	0.9750 (22a)
Adj infilt rate	0.0486	0.0474	0.0497	0.0451	0.0428	0.0393	0.0405	0.0370	0.0416	0.0451	0.0405	0.0451 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												81.9000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.1391	0.1379	0.1402	0.1356	0.1333	0.1298	0.1310	0.1275	0.1321	0.1356	0.1310	0.1356 (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
Windows/Doors (Uw = 1.00)			10.0600	0.9615	9.6731		(27)
Semi-Glazed Doors			1.6800	1.0000	1.6800		(26a)
Ground Floor			49.8400	0.1000	4.9840	110.0000	5482.4000 (28a)
Cavity Wall	64.4400	11.7400	52.7000	0.1300	6.8510	60.0000	3162.0000 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			114.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.1881		(33)
Party Walls			10.6800	0.0000	0.0000	180.0000	1922.4000 (32)
Party Ceiling			49.8400			30.0000	1495.2000 (32b)
Internal Walls			75.8400			9.0000	682.5600 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12744.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K		255.7095 (35)

### List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.8000	0.0580	0.3364
E3 Sill	1.4000	0.0450	0.0630
E4 Jamb	18.8000	0.0500	0.9400
E5 Ground floor (normal)	26.8500	0.0550	1.4768
E7 Party floor between dwellings (in blocks of flats)	26.8500	0.0000	0.0000
E16 Corner (normal)	4.8000	0.0440	0.2112
E18 Party wall between dwellings	4.8000	0.0620	0.2976

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.3250 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	26.5130 (37)

# Full SAP Calculation Printout



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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	5.4893	5.4436	5.5349	5.3523	5.2610	5.1241	5.1698	5.0328	5.2154	5.3523	5.1698	5.3523	
Average = Sum(39)m / 12 =	32.0023	31.9566	32.0479	31.8654	31.7741	31.6372	31.6828	31.5459	31.7284	31.8654	31.6828	31.8654	(39)
HLP	0.6421	0.6412	0.6430	0.6394	0.6375	0.6348	0.6357	0.6329	0.6366	0.6394	0.6357	0.6394	(40)
HLP (average)													0.6381
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	31

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

Assumed occupancy 1.6854 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 63.6313 62.6863 61.3555 58.9018 57.0645 55.0272 53.9268 55.2482 56.6871 58.8670 61.3713 63.4162 (42b)

Hot water usage for other uses 33.5685 32.3478 31.1272 29.9065 28.6858 27.4652 27.4652 28.6858 29.9065 31.1272 32.3478 33.5685 (42c)

Average daily hot water use (litres/day) 89.5131 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	97.1998	95.0341	92.4827	88.8083	85.7503	82.4924	81.3919	83.9341	86.5936	89.9942	93.7191	96.9847	(44)
Energy content (annual)	153.9408	135.3274	142.1425	121.5741	115.4364	101.4340	98.4365	103.9279	106.7785	122.1213	133.5201	151.8546	(45)
Distribution loss (46)m = 0.15 x (45)m	23.0911	20.2991	21.3214	18.2361	17.3155	15.2151	14.7655	15.5892	16.0168	18.3182	20.0280	22.7782	(46)
Water storage loss:													150.0000 (47)
Store volume													1.8600 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.7800 (49)
Temperature factor from Table 2b													1.4508 (55)
Enter (49) or (54) in (55)													
Total storage loss	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748	(56)
If cylinder contains dedicated solar storage	44.9748	40.6224	44.9748	43.5240	44.9748	43.5240	44.9748	44.9748	43.5240	44.9748	43.5240	44.9748	(57)
Primary loss	54.8576	49.5488	54.8576	53.0880	54.8576	22.5120	23.2624	23.2624	22.5120	54.8576	53.0880	54.8576	(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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	(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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870	(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	95.0714	84.6354	91.1484	82.8938	82.2687	51.7364	51.3400	53.1659	53.5135	84.4914	86.8658	94.3777	(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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	101.1235	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.2137	15.2891	12.4339	9.4133	7.0365	5.9405	6.4190	8.3436	11.1988	14.2194	16.5961	17.6921	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	219.1319	221.4058	215.6757	203.4768	188.0780	173.6052	163.9366	161.6627	167.3928	179.5917	194.9905	209.4633	(68)
Pumps, fans	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	46.7977	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	-67.4156	(71)
Total internal gains	127.7841	125.9455	122.5114	115.1303	110.5762	71.8561	69.0054	71.4596	74.3242	113.5637	120.6470	126.8518	(72)
	444.6353	443.1460	431.1265	408.5259	386.1963	331.9074	319.8665	321.9714	333.4214	387.8803	412.7392	434.5127	(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
North	2.1000	11.9957	0.5700	0.7000	0.7700	6.9655 (74)
South	3.5500	51.1372	0.5700	0.7000	0.7700	50.1962 (78)
West	4.4100	22.3485	0.5700	0.7000	0.7700	27.2517 (80)

Solar gains	84.4134	136.2008	192.9515	260.6001	295.6893	318.9379	300.7813	271.7553	229.7688	161.0126	101.8606	70.9218 (83)
Total gains	529.0487	579.3468	624.0780	669.1260	681.8855	650.8453	620.6478	593.7267	563.1902	548.8929	514.5998	505.4346 (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	110.6220	110.7800	110.4644	111.0973	111.4165	111.8987	111.7375	112.2225	111.5768	111.0973	111.7375	111.0973
alpha	8.3748	8.3853	8.3643	8.4065	8.4278	8.4599	8.4492	8.4815	8.4385	8.4065	8.4492	8.4065
util living area	0.8897	0.8264	0.7055	0.5461	0.3960	0.2673	0.1787	0.1913	0.3549	0.5724	0.7955	0.9080 (86)
Living	20.8685	20.9117	20.9482	20.9611	20.9629	20.9632	20.9631	20.9633	20.9631	20.9607	20.9312	20.8519
Non living	20.2457	20.2939	20.3302	20.3457	20.3489	20.3516	20.3507	20.3533	20.3498	20.3455	20.3204	20.2296
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	20.9327	20.9117	20.9482	20.9611	20.9629	20.9632	20.9631	20.9633	20.9631	20.9607	20.9312	20.8726 (87)
Th 2	20.3923	20.3931	20.3914	20.3947	20.3963	20.3988	20.3980	20.4004	20.3972	20.3947	20.3980	20.3947 (88)
util rest of house	0.8718	0.8038	0.6780	0.5178	0.3679	0.2381	0.1479	0.1594	0.3209	0.5382	0.7678	0.8918 (89)
MIT 2	20.3338	20.2939	20.3302	20.3457	20.3489	20.3516	20.3507	20.3533	20.3498	20.3455	20.3204	20.2593 (90)
Living area fraction									flA = Living area / (4) =			0.4687 (91)
MIT	20.6145	20.5835	20.6198	20.6341	20.6367	20.6382	20.6377	20.6392	20.6372	20.6338	20.6067	20.5468 (92)
Temperature adjustment												0.0000
adjusted MIT	20.6145	20.5835	20.6198	20.6341	20.6367	20.6382	20.6377	20.6392	20.6372	20.6338	20.6067	20.5468 (93)

## 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8786	0.8111	0.6885	0.5290	0.3791	0.2498	0.1602	0.1721	0.3345	0.5518	0.7777	0.8961 (94)
Useful gains	464.8192	469.8977	429.6520	353.9863	258.4899	162.5580	99.4125	102.1837	188.3668	302.8561	400.1800	452.9041 (95)
Ext temp.	4.6000	5.1000	7.0000	9.5000	12.5000	15.5000	17.5000	17.4000	14.7000	11.1000	7.5000	4.6000 (96)
Heat loss rate W	512.5018	494.7994	436.4878	354.7930	258.5352	162.5590	99.4125	102.1837	188.3790	303.7990	415.2555	508.1500 (97)
Space heating kWh	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029 (98a)
Space heating requirement - total per year (kWh/year)												110.5689
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	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												110.5689
Space heating per m2												(98c) / (4) = 2.2185 (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 %)												265.2579 (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	35.4758	16.7339	5.0858	0.5808	0.0337	0.0000	0.0000	0.0000	0.0000	0.7015	10.8544	41.1029 (98)
Space heating efficiency (main heating system 1)	265.2579	265.2579	265.2579	265.2579	265.2579	0.0000	0.0000	0.0000	0.0000	265.2579	265.2579	265.2579 (210)
Space heating fuel (main heating system)	13.3741	6.3085	1.9173	0.2190	0.0127	0.0000	0.0000	0.0000	0.0000	0.2645	4.0920	15.4955 (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	253.7732	225.4986	241.9749	218.1861	215.2688	167.4700	166.6737	172.1651	172.8145	221.9537	230.1321	251.6870 (64)
Efficiency of water heater (217)m	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169	171.5169 (216)
Fuel for water heating, kWh/month	147.9581	131.4731	141.0793	127.2097	125.5088	97.6405	97.1762	100.3779	100.7566	129.4063	134.1746	146.7418 (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	7.2878	6.5825	7.2878	7.0527	7.2878	7.0527	7.2878	7.2878	7.0527	7.2878	7.0527	7.2878 (231)
Lighting	15.0671	12.0874	10.8833	7.9736	6.1590	5.0320	5.6185	7.3031	9.4860	12.4462	14.0579	15.4858 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-32.6706	-53.7497	-96.4884	-134.1189	-158.6861	-156.5957	-152.4965	-137.8954	-108.7178	-72.9686	-39.3143	-26.3608 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

# Full SAP Calculation Printout



(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	-1.6130	-5.0852	-16.6473	-40.6165	-65.2995	-84.4949	-79.4886	-58.6635	-31.7340	-10.4546	-2.7107	-1.0660	(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													41.6835 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													171.5169
Water heating fuel used													1479.5028 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5880)													
mechanical ventilation fans (SFP = 0.5880)													85.8077 (230a)
Total electricity for the above, kWh/year													85.8077 (231)
Electricity for lighting (calculated in Appendix L)													121.5998 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-1567.9365 (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													160.6574 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	41.6835	21.5100	8.9661 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5028	21.5100	318.2411 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	85.8077	21.5100	18.4572 (249)
Energy for lighting	121.5998	21.5100	26.1561 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	21.5100	-251.6805
PV Unit electricity exported	-397.8738	5.5900	-22.2411
Total			-273.9216 (252)
Total energy cost			97.8989 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	41.6835	0.1606	6.6953 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1479.5028	0.1415	209.3127 (264)
Space and water heating			216.0080 (265)
Pumps, fans and electric keep-hot	85.8077	0.1387	11.9026 (267)
Energy for lighting	121.5998	0.1443	17.5506 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	0.1311	-153.3970
PV Unit electricity exported	-397.8738	0.1160	-46.1603
Total			-199.5573 (269)
Total CO2, kg/year			45.9040 (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	41.6835	1.5945	66.4629 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1479.5028	1.5232	2253.5338 (278)
Space and water heating			2319.9967 (279)
Pumps, fans and electric keep-hot	85.8077	1.5128	129.8099 (281)
Energy for lighting	121.5998	1.5338	186.5138 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1170.0627	1.4843	-1736.7554

# Full SAP Calculation Printout



PV Unit electricity exported	-397.8738	0.4252	-169.1582
Total			-1905.9136 (283)
Total Primary energy kWh/year			730.4069 (286)